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USER MANUAL

MTS^{e} 5000 Series

Manual reference:	5000M02 750000992/16
Software:	Versions 4.xx
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Visual Conventions

<Print>	Name of the softkey depending on the current function (displayed on the right of the screen).
Range	Information displayed on the screen.
PRINT	Direct access key (below the screen).
TITLE	Name of the menu displayed in the pull down menus.

Note — Information concerning the operation of MTS^e.

Important — Important information concerning the correct operation of the MTS^e.

Attention — Message warning the user of the risk of damaging the instrument or loosing information if the instructions are not respected.

Danger — Message warning the user that he could be injured if the instructions are not respected.

Laser safety

The provisions contained in two standards define the safety procedures to be observed both by users and by manufactures when utilizing laser products:

- EN 60825-1 : 1994 - Safety of laser products – Part 1: Classification of products, requirements and user guidelines.
- FDA 21 CFR § 1040.10 - Performance standards for light-emitting products - Laser products.

Due to the range of possible wavelengths, power values and injection characteristics of a laser beam, the risks inherent in its usage differ. The laser classes form groups representing different safety thresholds.

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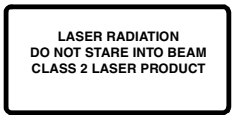
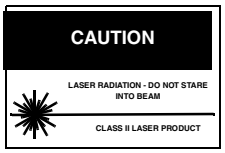
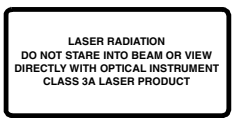
Laser classes applicable to the MTS^e modules:

	Reference standard	
Modules	**EN 60825-1 :1994**	**FDA21CFR§1040.10**
Multimode MM and ML - at 1300 nm - at 850 nm	 Class 1 Class 3A	 Class 1 Class 1
Singlemode SR, DR	Class 1	Class 1
Singlemode HD - at 1310 nm, 20 µs - at 1310 nm, other pulse widths - at 1550 nm	 Class 3A Class 1 Class 1	 Class 1 Class 1 Class 1
Singlemode VHD - at 1310 nm, 10 and 20 µs - at 1310 nm, other pulse widths - at 1550 and 1625 nm	 Class 3A Class 1 Class 1	 Class 1 Class 1 Class 1
VFL option	Class 2	Class 2

Warning labels for the laser classes of the MTS^e

Due to the reduced dimensions of the optical modules, it is not possible to attach the required warning labels to them. In line with the provisions of Article 5.1 of the EN 60825-1 standard, the warning labels are illustrated in the following table.

Warning labels	**Reference standard**	
	EN 60825-1 :1994	**FDA21CFR§1040.10**
Class 1		
Class 2		
Class 3a		

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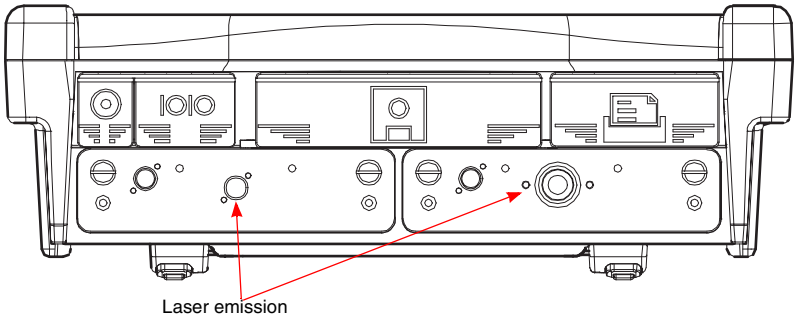
Optical connector

The optical connector is the access point to the laser beam (see figure below).



Example of a laser connector on the MTS 5100^e rear panel

The user must take the necessary precautions concerning the optical output of the instrument and follow the manufacturers instructions.

Important — Measurements on optical fibers are difficult to execute and the precision of the results obtained depends largely on the precautions taken by the user.

AC/DC and battery safety

Important — In conformance with the recommendations of standard EN 61010, the instrument should be operated within the manufacturer's guidelines. Failure to do so may compromise the protection offered by the instruments design.

Important — Do not use any AC/DC adaptor or battery other than the supplied accessories. If another adapter or battery is used, it may damage the MTS^e itself.

The MTS^e is supplied with a Nickel Metal Hydrid rechargeable battery.

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Chapter

1 Measurement Principles

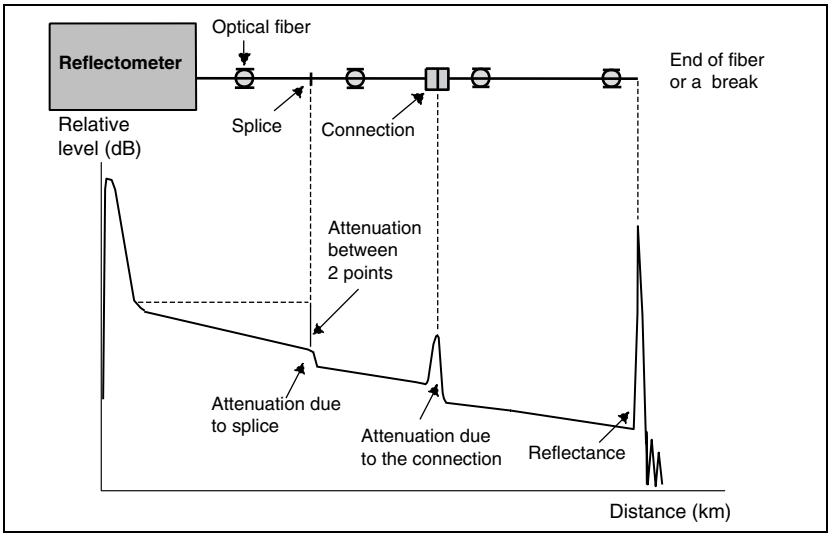
This chapter give the principle of measurement :

- ❏ for OTDR modules
- ❏ for OTS modules
- ❏ for the WDM modules

OTDR measurements principle

Optical time domain reflectometry consists of injecting a light pulse down the optical fiber to be analyzed and observing, at the point of injection, the intensity of the light reflected back in the opposite direction to the pulse propagation.

The detected backscattered (or retrodiffusion) signal is a decreasing exponential, to which peaks caused by reflection from fiber connectors, splices or faults are added.



Typical backscattered trace

Measurement result

The backscattered signal primarily allows the location of a segment of the fiber to be found on the link.

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The measurement result should provide:

- the attenuation
- the location of faults in terms of distance from defined point
- the attenuation versus distance (dB/km)
- the reflectance of an event or an optical link

Attention

In so far as location is concerned, it should be noted that an OTDR is a time domain machine (Optical Time Domain Reflectometer). Consequently, group velocity must be introduced in order to determine the distance of the location. This is done by introducing the refractive index of the fiber into the instrument.

Measurement validity

The ITU-T Recommendations G.651 and G.652 state backscatter measurement as the second replacement method for the measurement of attenuation. The cut fiber technique is the reference method.

The field of application for backscatter measurement is not limited, but the conditions for application of this method are nevertheless stipulated:

- In so far as insertion conditions are concerned, Fresnel reflections should be limited at fiber input.
- A high power source (laser) should be used.
- Receiver bandwidth should be selected so as to achieve a compromise between pulse rise time and noise level.
- Backscatter power should be represented on a logarithmic scale.

Reflectance

Reflectance is a characteristic allowing the reflection coefficient of a reflecting optical element to be quantified. It is defined as the ratio of the power reflected by the element over the incident power.

The reflections are due to variations in refractive index along the fiber optic link, in some Telecom applications. If these reflections are not controlled they may degrade the system performance by perturbing the laser emitter operation (particularly DFB lasers), or, in the case of multiple reflections, generate interference noise in the receiver.

The OTDR is particularly suited to reflectance measurements on a fiber link. The amplitude of the generated Fresnel reflection is measured, then the result is converted to reflectance.

The conversion formula takes into account:

- the amplitude of the reflection measured
- the pulsewidth used to measure the reflection's amplitude (in nanoseconds)

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- the backscattering coefficient of the fiber used.

Typical values of backscattering coefficient for a 1ns pulse	
for a singlemode fiber	- 79 dB at 1310 nm - 81 dB at 1550 nm and 1625 nm
for a multimode fiber	- 70 dB at 850 nm - 75 dB at 1300 nm

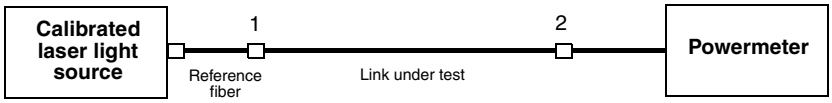
In order to measure the largest range of reflection coefficient, a variable optical attenuator must be inserted between the OTDR and the link under test. This attenuator allows the level of the curve to be adjusted so that the OTDR is never saturated by the reflection to be measured.

OTS Measurement principles

Attenuation measurement

The attenuation measurement in power of a complete link or elements such as fiber sections, connections, optical components, requires a calibrated laser light source and a power meter.

This is generally deducted from the optical power measurement at two points:



Loss $A_{(dB)} = P1_{(dBm)} - P2_{(dBm)}$

Important To make accurate measurements the following conditions are required:

- Use a light source that is stable in time and in respect to the temperature.
- Verify that the connections, the fibers and the receiving cell are perfectly clean.
- Use a reference link between the laser source and the element under test. To make several measurements with the same light injection conditions, the reference fiber must not be disconnected during the measurement period.

Two methods are used to measure the fiber optic attenuation:

- The cut fiber method
- Insertion loss measurement method

Cut fiber method

1. The power P1 at the output of the fiber under test is measured, then the fiber is cut approximately two meters from the extremity at the source end.

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2. The power P2 at the output of the fiber section of two meters is measured and serves as the reference.
   The attenuation of the fiber tested is: P1 - P2.

This method is very accurate but is little used due to its destructive nature. It cannot be used during maintenance or installation but only during the manufacture of the fiber.

Insertion loss measurement method

1. The power meter is first connected to the laser source via the reference fiber: P1 is measured.
2. The fiber to test is inserted between the reference fiber and the power meter: P2 is measured.
3. The difference between P2 and P1 gives the attenuation of the fiber under test.
   It is preferable to use the same type of connector at the extremities of the fiber tested, in order to have the same connection conditions for the P1 and P2 measurements.
   Although this method is less accurate than the previous method it is the most common because it is non destructive.

Measurement accuracy

- Very high accuracy is often necessary, It is therefore essential to first make a calibration without the fiber under test to eliminate as much as possible losses due to the connections. To do this use the OTS *"reference value"* function.
- For measurements in a laboratory where the two extremities of the fiber are at the same site the repeatability of the attenuation measurements is better than 0.1 dB. For measurements in the field, with the extremities of the fiber at different sites, the variations between measurements is in the order of ± 0.2 dB (using a relative measurement).

Power measurement

The measurement of the power transmitted or received only requires a power meter:

- To measure the transmitted power, connect the power meter directly to the output of the optical transmitter.

To measure the power at the input of an optical receiver, the power meter is connected at the extremity of the fiber, where the optical receiver will be connected.

WDM principle and analysis

The Wavelength Division Multiplex (WDM) technology is a very effective way to increase the capacity of the fiber without having to install new links. Instead of increasing the data rate, it enables the fiber to carry several wavelengths, each wavelength transmitting signals. Channels are defined by the ITU-T recommendations G-692.

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With this new technology, new measurements are required. During installation and maintenance of WDM systems, it is important to verify the following parameters:

1. Presence of all channels at corresponding wavelengths, without any drift.
2. Right channel power levels, without any power variation
3. Enough signal over noise ratio (SNR). This value is determined by measuring the ratio of the peak channel power to the noise power level of the ASE[1] noise signals to the left and/or right of the carrier. Usually, the noise measurement point is chosen as the calculated mid-point between two adjacent channels. The measured noise power level is converted to a standardized bandwidth of 0.1 nm.

The most important test equipment for WDM systems able to perform those test is the spectrum analyser. This analyser can be connected along the WDM system on all critical measurement points, located at the extremities of the links or at the amplifier locations.

Measurement results

The optical spectrum analyser displays a waveform which is showing all the channels. Measured results are presented on a complete spectral analysis and as a WDM table, listing all carriers with their relevant parameters.

The optical spectrum analyser is performing automatic detection and measurement for all channels.

The number and the composite power are provided like, for each channel:

- the wavelength
- the spacing
- the power level
- the signal over noise ratio

The total power of the system could also be provided.

In order to qualify the amplifier, tilt and slope gain could be calculated. In principle, the amplification shall be flat over the full WDM spectrum.

1. Amplified Spontaneous Emission

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Chapter 2

Introduction

The Acterna 5000 series Media Test Set is a fully modular portable platform designed for the construction, commissioning and maintenance of fiber optic networks. This dedicated cost effective instrument allows testing to be fast and easy.

It has the following principle characteristics:

- ❏ It has a modular design that allows interchangeable modules to be adapted for any present or future fiber optic application requirements. The MTS^e modular structure provides the flexibility and upgradeability for it to be the tester of choice for extremely dynamic and rapidly growing telecommunications, CATV and datacom markets. Easy field exchange modules minimize the number of instruments to be carried.
- ❏ It can contain in a small package, multiple OTDR functions, Fault Locator, WDM analyzers, light source, power meter, VFL (Visual Fault Locator), OTS (Optical Test Set), Talk Set, etc.
- ❏ Its "RISC" microprocessor coupled with an optimized time base guarantees excellent acquisition and processing speed.
- ❏ Multitasking allows several operations to be performed at the same time, i.e. acquisition, modification of parameters, file analysis, printing.
- ❏ Software upgrades are easily achieved using the internal 3" 1/2 floppy disk drive.
- ❏ The measurement results can be stored in the internal 3 Mb SRAM memory or, as an option, on a hard disk drive (1 Gb) or floppy disk drive.
- ❏ The measurement tool, printing and file storage in the universal Bellcore GR-196-CORE format, simplifies report creation.
- ❏ The easy to use Man-Machine interface means becoming familiar with the instrument is rapidly achieved. An external keyboard facilitates entry of data.
- ❏ Its compact rugged box allows the instrument to withstand severe environmental operating conditions.
- ❏ The MTS 5100^e is a mini-OTDR perfectly designed for field use.
- ❏ The MTS 5200^e, although in a very compact unit, is a classic mainframe OTDR providing high level performance and functions, including a built-in printer and IEEE interface.

Interchangeable modules

The MTS^e can be equipped simultaneously with one or two of the following modules:

- OTDR singlemode modules: SR, DR, HD, RTU
- OTDR multimode modules: MM, ML
- WDM modules

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- OTS modules: power meter, light sources and talk set.

Measurements

The MTS^e allows long and short range tests to be made, in singlemode or multimode, on point-to-point or complex optical networks during:

- the design and production of the equipment
- the installation and qualification of the equipment of the network
- the maintenance of the network

Les mesures peuvent être réalisées sur des liaisons optiques en service.

Measurements can be carried out on in service optical links with the 1625 nm wavelength.

Simply pressing the **START/STOP** button starts or stops a measurement.

Setup

Pressing the **SET-UP** key provides access to the MTS^e configuration menus:

Test setup

On the same screen, dialog boxes allow the selection of measurement parameters, the results display and the parameters of the fiber.

System setup

On the same screen menus provide selection of:

- the screen parameters (automatic power off, backlight strength, contrast, welcome message),
- the country parameters (date, time, date/time format, length units, language)
- the printing parameters: internal (MTS 5200^e only) or external printer or copy to file, type of external printer, printing contents (trace or table or both)
- the I/O interface parameters : RS 232 or Ethernet (option) or IEEE (MTS 5200^e only), connector Centronics for keyboard or printer.

For a full description of the system set-up menus see "System setup" on page 3-12.

Instrument setup

A graphical screen displays all the modules available on the instrument and the user can select the test functions. Only the Laser Source and Power Meter can be simultaneous.

When the instrument is switched off, its configuration along with the measurement results are saved.

The configuration menus can be displayed and modified during an acquisition or a measurement. Some parameters are inhibited during acquisition.

Results

After any measurements, the trace and the associated results are displayed. The **RESULTS** key calls back these trace and results after another display.

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Printing

It is possible to print the displayed screen either on an internal (MTS 5200^e) or external printer or to create a bitmap (.bmp) type file and store it on a floppy disk.

The external printer uses the Centronics port. Epson, Canon or HP compatible printers can be used.

Simply press the **PRINT** button to print the trace displayed or create the file on the floppy disk.

Memory

The **FILE** key calls up the file management menu:

- to choose the storage medium: internal memory (SRAM or hard disk) or floppy disk; the name and the format of the file; information linked to the data stored in the file.
- to store files or to retrieve them in order to carry out selection, copy, or deletion operations; with possibility to store them in directories and sub-directories.

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Chapter 3

Getting Started

This chapter explains the operations to carry out to start using the MTS^e:

- ❏ before switching on:

  unpacking the instrument,
  installation and removal of a module,
  charging and installing batteries,
  connecting an external power supply,
  connecting the fiber,
  positioning the unit,
  connecting the handle or carrying strap.

- ❏ after switching on:

  installing new software from a 3.5" floppy disk,
  configuring the system (date, time, language, etc.).

- ❏ troubleshooting.

Before switching on

Unpacking the instrument

Remove the MTS^e and its accessories from the packing case. Check the presence of all the ordered accessories.

If any part is missing or damaged please contact your local representative (see "Wavetek Customer Service Centers" at the end of the manual).

The MTS^e is delivered with the following accessories:

- a user manual.
- a battery that must be charged before use.
- a mains supply unit to power the instrument from the mains and to charge the batteries.
- a carrying strap.
- soft carrying case (optional)
- hard transit case (optional)

Installation and removal of module

It is very easy to remove or install a MTS^e module. Whatever type of module, it can be installed in either of the two slots available on the rear panel of the instrument.

When a slot is empty it is covered with a blanking plate attached with two locking screws similar to those of a module.

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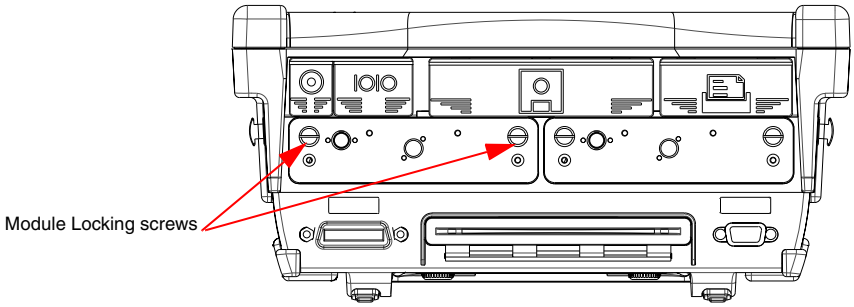

MTS 5200^e rear view

Removal of module

Attention

The MTS^e must be switched off and, if AC powered, the cord must be disconnected.

1. Completely unscrew the two large locking screws of the module.
2. Carefully pull the module backwards to slide it out of its slot.

Installation of module

Attention

The MTS^e must be switched off and, if AC powered, the cord must be disconnected.

1. Make sure that the two large locking screws of the module are completely unscrewed.
2. Carefully slide the module back into its slot.
3. Once the module is fully pushed back into its slot, keep pressure applied to the front face while tightening the two locking screws.

Important

You must fully tighten the screws to their stops. The rear panel of the module should be aligned with the rear panel of the chassis.

Positioning of the unit

Depending on the working conditions during operation, the MTS^e can either be stood on a work top or hand held. In both cases it has several positions.

Used on a work top, the MTS^e can be positioned:

1. Vertically, when the operator is sitting down
2. Horizontally, if imposed by environmental conditions
3. At 45° using the stand, when the user is standing up.

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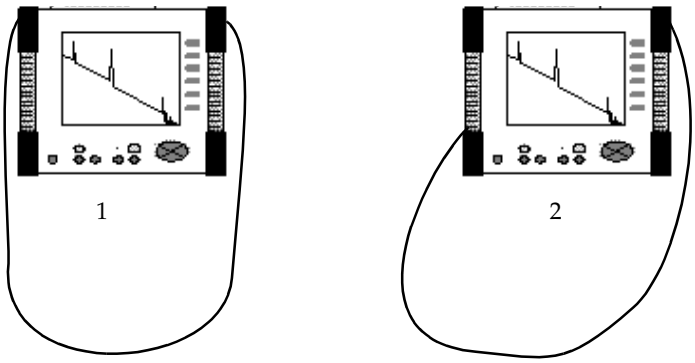
When the MTS^e is being held during use, the support strap should replace the carrying handle. Two positions are available:

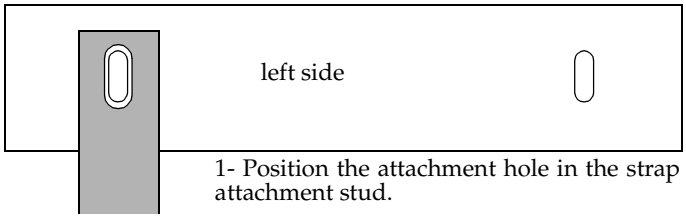
1. MTS^e held in front, with the strap hanging around the neck of the user. The carrying strap must then be fixed at the upper studs, as shown in the following figure 1.
2. MTS^e held at the side, with the strap hanging around neck and under the arm of the user. The carrying strap must then be fixed at one upper and one lower studs, as shown in the following figure 2.



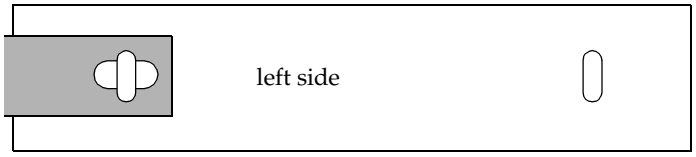
Possible strap positions

Positioning the handle or the carrying strap

The handle and straps are attached with metal studs to the sides of the instrument as follows:



1- Position the attachment hole in the strap in-line with the attachment stud.



2- Rotate the handle through 90° so that it is locked onto the attachment stud.

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Use the same procedure to attach the opposite end of the handle or strap.

The transport handle is attached to two metal studs on the left hand side of the instrument.

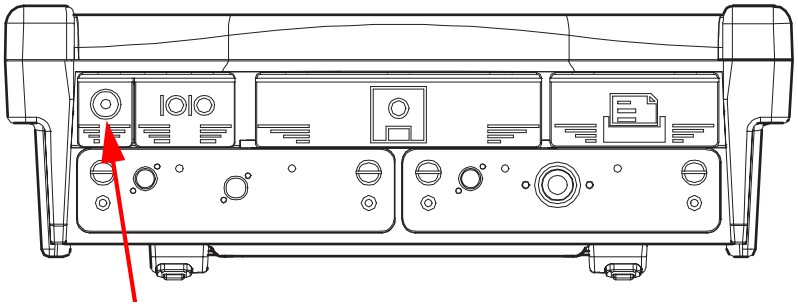
The strap is attached to both sides of the instrument as follows:

- Attached to the top studs on each side of the instrument. In this position, the strap can be used as a carrying strap. It can also, be passed around the users neck, to be used to provide support during hand held operation of the instrument in the field.
- Attached to the top right and bottom left studs. In this position the strap can be passed around the neck and under an arm to provide support when the instrument is held at the side.

Charging the batteries

The battery provided with the MTS^e, needs to be fully charged before use. The following instructions are relevant for both a single battery or for two batteries installed in the instrument.

The **Charge** indicator situated below the ON/OFF switch indicates the battery charge state (see "Charge indicator" on page 3-5).



Socket for external mains adapter (example with MTS 5100^e)

To charge the batteries, proceed as follows:

Important To efficiently charge the battery, the MTS^e screen must be switched off.

Connect the mains adapter from the mains supply to the MTS^e (see above).

The LED Charge switches on : the battery will charge in 2,5 hours (for a battery totally uncharged).

Important If the charge of the battery is ≥ 95% (typical), the charge will not start.

Once the battery is fully charged the **Charge** indicator switches off. The mains adapter can be disconnected and the MTS^e can be supplied from the battery or

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the batteries and mains adapter can be left in place and it is powered from the mains.

Important
It is imperative to let the battery reach the end of its charge to provide the maximum autonomy. If this is not done this period will be considerably reduced.

Important
The battery charge indication on the screen is only accurate if a full charge has been performed.

Important
If you do not intend to use the MTS^e for several weeks, it is recommended to remove the batteries to prolong their life and to fully recharge them before use.

Attention
If the ambient temperature is above safety threshold, the charge is automatically stopped.

Battery management

On the screen: the presence of one or two batteries is indicated, together with their state of charge.

If the instrument is fitted with two batteries, as soon as one of them has discharged, the supply source for the MTS^e is automatically switched to the other battery.

Autonomy

- If the battery has been fully charged, the autonomy reaches up to 8 hours of standard use, with low backlight, according to Bellcore /Telcordia GR-196-CORE standard.
- If acquisitions are permanently made, with low backlight, the unit can be operated during 3 hours.
- If acquisitions are permanently made, with high backlight, the unit can be operated during 2 ½ hours.

Charge indicator

- **If the green LED is on**: the instrument is switched off and is being charged from the external source.

To install the battery in the instrument, proceed as follows:

1. Under the MTS^e, remove the battery compartment door after removing the two attachment screws.

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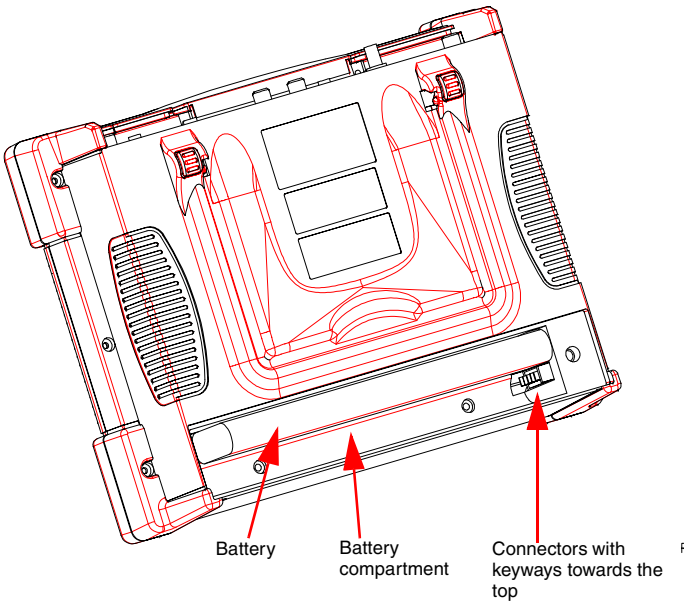

Installing the battery (example with MTS 5100^e)

2. A keyway on the connector of the battery avoids any connection errors. Position the battery in its compartment, keyway towards the top and push the battery until it connects to its connector.
3. If necessary, repeat the procedure for the second battery.
4. Replace the battery door and tighten the two attachment screws.

Important recommendations concerning batteries

Nickel-metal hydrid batteries are designed to ensure maximum safety. Each cell includes a resealable pressure relief mechanism (safety vent) to prevent excessive build-up of pressure in the cell in the event it is overcharged or exposed to extremly high temperatures.

Attention

You must only use the batteries delivered with MTS^e. Even though batteries delivered with other electronic equipment may appear identical, they risk damaging MTS^e.

Attention

If you don't intend using MTS^e for several weeks it is recommended that you remove the batteries in order to prolong their life cycle, and to recharge them before re-using them again.

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Using MTS^e from the mains supply

The mains adapter allows the MTS^e to be used, while charging the batteries, or during a measurement to save battery life, if a mains supply is available.

Attention
You must only use the mains adapter supplied with the MTS^e. Even though mains adapters delivered with other electronic equipment may appear identical, they risk damaging MTS^e.

- Connect the adapter to a mains outlet.
- On the rear panel of the MTS^e, remove the power supply connector blanking cap and connect the cable from the mains adapter. The "AUTO TEST Vx.x" message is displayed on the screen for a short period and the and the **On** LED is on. Then the **On** LED flashes : the instrument is ready to be started
- To switch on the instrument, press the **On** button.
  If the instrument is not switched on and if it contains a battery which needs a charge, the charge will start within 10 seconds max. and the **Charge** indicator will then be on until the end of the battery charge.

Note
During battery operation it is possible to change to mains operation without data loss.

Note
During mains operation it is possible to change to battery operation without data loss. But it is necessary to wait about 3 minutes to have a correct display of the battery charge level.

Note
When the OFF button is pressed, the current results and configuration are saved. When the On button is pressed they are recalled.

Attention
If there is a loss of power during operation the current results and configuration are lost. The next time the instrument is switched on, the initial configuration will be used.

Connecting the fiber

Connect the fiber to the tester as follows:

- If necessary remove the dust cap from the optical socket situated on the rear panel of the MTS^e
- Use a dry air spray to remove any dust from the fiber connector and the optical socket of the MTS^e.
- If an universal connector is used, verify that the relevant adapter is connected.
- Connect the fiber connector to the optical socket of the MTS^e.

Attention
Take care to correctly align the connector to the optical socket otherwise the results obtained by MTS^e will be affected by this bad connection.

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Attention

Refer to the Maintenance Chapter for all the precautions relative to fiber optic connectors.

Note

The connection quality indicator is displayed on the screen when the measurement is started.

Switching on/off the MTS^e

Switching on the MTS^e:

- Press the **ON/OFF** button.
  When operating on battery, an **AUTOTEST VX.X** message appears on the screen. Then, the display is blank for approximately 2 seconds. Then a self test is carried out.

  If the MTS^e is used from the mains supply, report to page 3-7.

  The opening screen is displayed showing:
  - the actual time and date,
  - the charge level of the battery or the batteries[1] or the mains icon
  - the serial number of the instrument,
  - the date of the last calibration
  - the graphic of the MTS^e showing the modules and options installed.
- If the battery level is too low (less than 10%), then a warning is displayed on the screen. You must store your results and switch off the unit.
- If the battery level is below 5%, then a beep occurs periodically. When the battery is too low, the MTS^e is automatically switched off with storage of the current configuration.

Switching off the MTS^e

When the MTS^e is on, press the **ON/OFF** button to switch it off.

Note

When the instrument is switched off, a beep is emitted to indicate that it is possible to restart it. Any attempt to restart it before this beep is emitted, will fail.

Reset

If the MTS^e is blocked, it can be reset by holding down the ON/OFF, button (for about 4 sec.)

1. This battery level does not appear immediatly. A few minutes are necessary to have a correct display of this level.

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23/08/00 12:44
MTS 5100e S/N : 2713
Colour Display ....Present
Hard Disk ..... Present
Floppy Drive ..... Present
Ethernet..... Absent
Left Module ..... Present
Right Module ..... Present
Calibrated on 30/06/00
Press HELP again for further information
Hold START key to begin real time mode
Press START key to start averaging
Press SET-UP to configure the instrument
Press RESULTS to analyse the trace
OSA : 5071WDM
S/N : ok
Calibrated on 21/08/00
OTDR : 5026DR 1310/1550 nm
S/N : 104
Calibrated on 05/04/00
Software V2.39 Sep 11 2000

Opening screen example (MTS 5100^e)

After switching on

Installing a new version of the software

Attention

During the installation of a new version of the software, there is a risk to reset the internal memory. It is therefore recommended, before installing the new software, to make a copy of the traces in memory, using the Copy option of the File manager menu, called by the **FILE** button.

Attention

Do not stop the process of software upgrade: you may damage the unit.

Attention

During the installation the MTS^e must be used from the mains supply and not from batteries.

New software media

The application software is supplied on floppy disks: code 890 110 185/xx.

If the actual MTS^e boot version is less or equal to 4.5[1], the new boot needs to be installed. It is then supplied on two floppy disks: code 8901 10186/xx.

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The user will receive the set of floppy disks he need to upgrade his MTS^e.

Installation of the boot (if necessary)

1. The MTS^e being switched off (AC/DC adapter unplugged), insert the disk 1 of the boot into the floppy disk drive.
2. Plug in the AC/DC adapter. The floppy disk drive will then work and the MTS^e will automatically begin to transfer the software from disk 1 to the RAM. The screen is switched on :
   "Starting file transfert to RAM"
   . . . . . .
   The dots from the left to the right are showing the load in progress.
3. When the following message appears insert disk 2 and hit the OK key.
   "***Insert next boot disk and hit OK when ready.***".
4. If the main power is not on, the following message appears :
   "***PLUG-IN EXTERNAL POWER TO CONTINUE***".
   You have to connect this external power supply. It is automatically detected.
   "***Do not remove power before flashing is complete***"
   This message is very important: if you stop the process, the MTS^e may be damaged.
5. After the message "***Boot flashing has begun***" wait for the following message "***Boot flashing successful***". The boot software is then installed.
6. You can press **ON** when the MTS^e is ready (LED **ON** flashing) to check it is operating correctly.
7. Switch off the MTS^e and unplug the external power before starting to load the application software.

Installation of the application software

Proceed as follows to install the new software:

1. With the MTS^e switched off (AC/DC adapter unplugged), insert the disk 1 into the floppy disk drive.
2. Plug in the AC/DC adapter. The green LED of the floppy disk drive lights up and the MTS^e will automatically begin to transfer the software from disk 1 to the RAM.
   "***Starting file transfer to RAM***"
   . . . . . .
   The screen is switched on and some dots appear from the left to the right to show the transfer in progress.
3. Insert disk 2 and hit the OK key when the following message appears
   "Insert next boot disk and hit OK when ready.".
4. Repeat the preceding step, inserting the next disks.
5. Once all the disks have been transferred, the MTS^e prompts you to confirm that you wish to update the internal memory with this new software release, by the message:
   "***Current Flash contents will be erased, continue? (Y/N)***"

1. this version is displayed when the MTS^e is switched on, during the autotest.

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Press the YES key.
"***Programming flash memory; in progress***": the MTS^e then programs its internal memory and starts up the new MTS^e software.

"***Completed***" appears then the screen is blank: the software upgrade is completed. The MTS^e is ready for use when the LED **ON** is flashing.

6. Press the **ON** key to switch it on.

Instrument Set up

The instrument can be equipped with up to two modules and with several test functions. Before making measurements, it is necessary to select the function or functions required in the Instrument Set-up menu.

If a module has been changed, after power up, the unit will directly go to this Instrument Set-up menu.

The Talk Set option can be selected even if an OTDR function is selected. OTDR, OSA, VFL and Loss Test Set (Power Meter & Laser Source) functions are exclusive: the selection of one of them will cancel the previous selection.

To configure the instrument

Press the **SET-UP** button : the configuration menu is displayed with the last type of configuration defined: Test, System or Instrument.

If the configuration menu displayed is not the one required, press the <Instrument Setup> key.

The functions of the instrument are graphically displayed : OTDR, OSA, Source, Power Meter or Visual Fault Locator installed according to the modules present in the MTS^e.

To validate a function:

- Use the directional arrows to move to the function icon.
- Press the Select button to validate the choice. The icon will then be highlighted (in red with color screen) and the connection to the relevant connector will be displayed.

If none of the function is selected

- The MTS^e is in the OTDR mode if an OTDR module is present, but no acquisition can be made. You can however analyze, store and recall traces.
- The MTS^e is in the WDM mode if an OSA module is present but no OTDR module.

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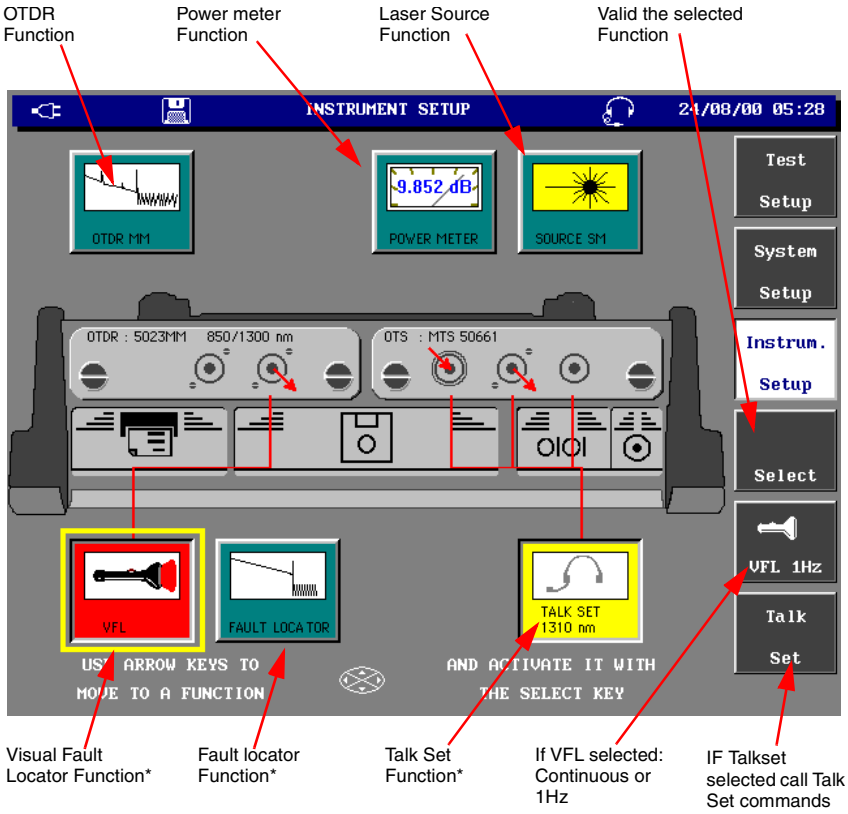

* (if the option is present)

Configuration screen of the instrument
(example with MTS 5100^e and OTDR and OTS modules)

System setup

When first using the MTS^e or before a measurement session, the system parameters should be configured:

- MTS^e hardware parameters
  (contrast, automatic power off, bright or dim screen lighting, , black or white trace background)
- country parameters
  (date, time, date/time format, length units, language)
- printer parameters (printer type, copy on file, printer contents)
- input/output parameters (remote control, Centronics port allocation).

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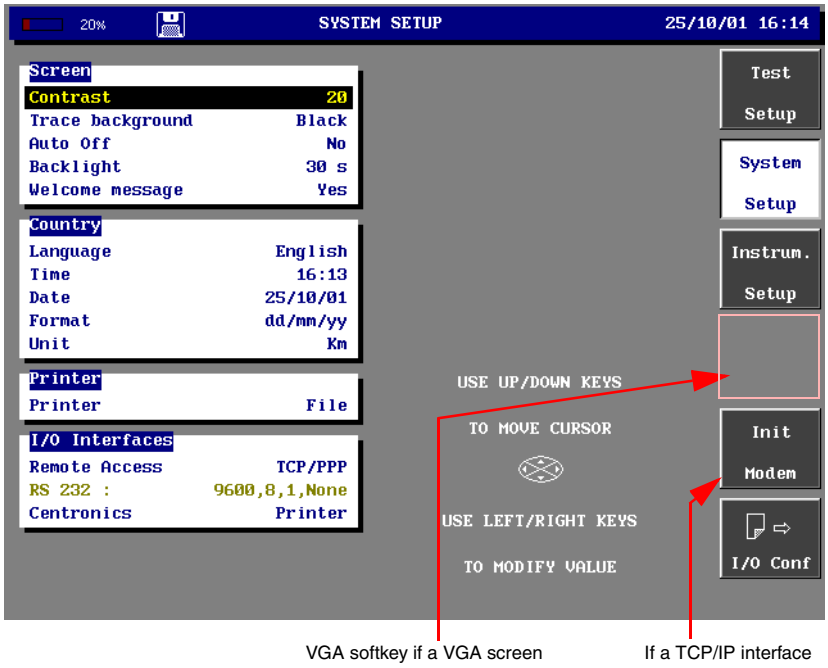
To modify system setup parameters

- With the MTS^e powered up, press the **SET-UP** button.
  The configuration selection keys are displayed on the screen.
- Press the <System Setup> menu key.
- Use the displacement keys ↑and ↓ to move the cursor to the element to modify. The available values for the parameter selected are displayed on the right.
- Use the displacement keys → or ←, to choose the required value.



System Set-up screen

Adjusting the screen contrast (B & W screen only)

This adjustment is only available with a B & W or passive color screen (option 5000/PAS).

- Press the **SET-UP** button, then with the <System Setup> key, in the Screen window, move the cursor to Contrast.
- Use the → or ← keys to modify the contrast (level from -20 to +20).
  The contrast remains at the selected level.

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Choosing the color of the trace background

Press the **SET-UP** button, then press the <System Setup> menu key in the Screen window. Place the cursor on "Trace Background" and then choose either Black or White.

If the instrument includes a VGA monitor, then the <VGA> key enables the transfer of information to this screen (see page 4-11).

Auto off

Note

The Auto off function is valid only with battery operation, to preserve battery life.

This function automatically powers down the instrument if no action is performed or no key is pressed for the delay selected in this menu, after saving the session underway.

- To validate this function, from the Screen window, move the cursor to Auto Off and select the time (5 min. or 15 min.) at which time the instrument will automatically power down if no key is pressed.
- To disable this function, from the Screen window, move the cursor to Auto Off and choose the No option.

Back-lighting level

Press the **SET-UP** button, then with the <System Setup> key, in the Screen window, move the cursor to Backlight.

- Choose the No option to select the normal screen level lighting.
- In dim lighting conditions, choose the Always option for the screen to be permanently back-lit.
- Choose one of the options 3 min. or 30 sec to have a back-lit screen for the chosen period. This backlight will then be available.

Important

When the MTS^e is operating on battery, it is recommended to select the No or 30s backlight option, in order to maximize the autonomy.

Welcome message

The Welcome message gives the main possible actions after powering on the unit.

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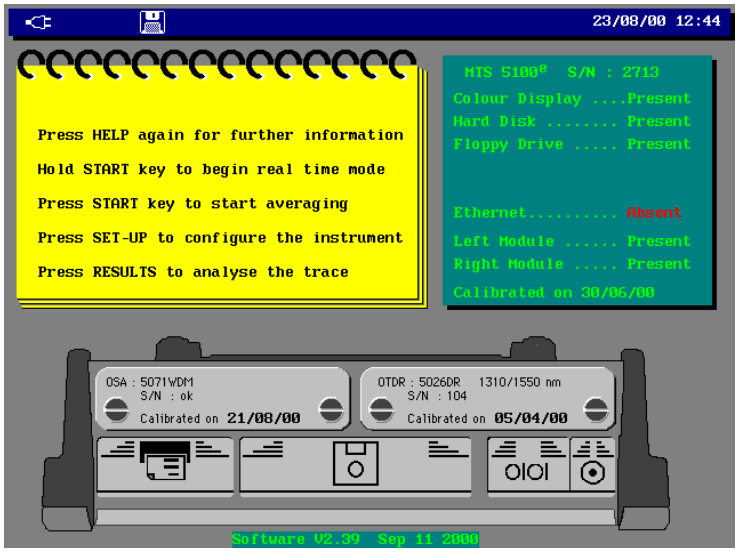
23/08/00 12:44
MTS 5100e S/N : 2713
Colour Display ....Present
Hard Disk ..... Present
Floppy Drive ..... Present
Ethernet..... Absent
Left Module ..... Present
Right Module ..... Present
Calibrated on 30/06/00
Press HELP again for further information
Hold START key to begin real time mode
Press START key to start averaging
Press SET-UP to configure the instrument
Press RESULTS to analyse the trace
OSA : 5071WDM
S/N : ok
Calibrated on 21/08/00
OTDR : 5026DR 1310/1550 nm
S/N : 104
Calibrated on 05/04/00
Software V2.39 Sep 11 2000

Welcome message (example with MTS 5100^e)

If you don't want this message at each power on, press the **SET-UP** button, then with the <System Setup> key, in the Screen window:

- move the cursor to Welcome message
- select the No option.

  The Yes option will restore this message at each power on.

Setting the time

Press the **Set-up** button, then with the <System Setup> key, in the Country window, move the cursor to the Time option. The Hour and Minute keys are displayed.

- Press the → or ← displacement keys to modify the minutes and hours.

Setting the date

- Press the **SET-UP** button, then with the <System Setup> key, in the Country window, move the cursor to the Date line. The date is displayed according to the format defined on the following line.
- Modify the date using the → or ← displacement keys.

Choice of date format

- Press the **SET-UP** button, then with the <System Setup.> key, in the Country window, move the cursor to the Format option.
- Choose one of the options dd/mm/yy (day/month/year) or mm/dd/yy (month/day/year) for the required date format.

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Choice of length (OTDR) or frequency (WDM) unit

Press the **SET-UP** button, then with the <System Setup> key, in the Country window, move the cursor to the Unit option to choose :

- kilometers, kfeet or miles for an OTDR trace (MTS with OTDR module).
- THz or nm for a WDM spectrum (MTS with WDM module)

Choice of language

Press the **SET-UP** button, then with the <System Setup> key, in the Country window, move the cursor to the Language option to choose the required language.

Choice of printer

In the Printer window move the cursor to Printer to choose one of the options :

File	save the display to a bitmap file
None	no printer selected
Internal	if the 5200 /PR optional internal printer is present (in the MTS 5200^e mainframe only).
External	to use an external printer connected to the Centronics port.

Choice of the printing mode

This choice is present on the MTS 5200^e version, if the internal printer is selected:

Normal	printing in the direction of the length of the paper roll, consequently the size of the characters provides easier reading than in the following mode.
Compress	printing across the width of the paper roll (see the examples on page 3-22).

Choice of the external printer type

If the external printer has been selected in the Printer window, move the cursor to Printer type to choose one of the options:

Epson B&W	for Epson FX-850 printer type
Epson LQ	for Epson Stylus color printer type
Canon BJC70LQ	for Canon BJ 30, Canon BJC 70 and Canon BJ200exprinter types
Canon BJC240 LQ	for Canon BJC 240 printer type
HP	for HP Deskjet 500, 510, 520, 540, 560, 660C, 690C, 895 Cxi and HP Laserjet 3, 4, 5, 6J printer types.
DPU 411	for Seiko DPU 411 printers

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Choice of the content of the copy (on internal or external printer)

In the Printer window move the cursor to Printer Contents to choose one of the options:

Trace	copy of the trace only together with the header (not available with OTS module).
Table	copy of the table only together with the header
Trace + Table	copy of the trace and the table together with the header (not available with OTS module).
Screen	copy of the screen.

Report on page 3-22 to see examples of printing for each options.

I/O Interfaces

Remote access line :

IEEE :	(for the MTS 5200^e mainframe only, if it is equipped with the IEEE optional interface) Press the IEEE key to select the IEEE address
RS 232	Press the RS 232 key to select the parameters: Baud rate: 300, 600, 1200, 2400, 4800, 9600, 19200, 38400, 57600 or 115200 Protocol: None, Xon/Xoff, Rts/Cts Parity: None, Even, Odd Data bits: 7 or 8 bits Stop bits: 1 or 2 bits Terminator: CR, LF or CR/LF See chapter chapter 9 for more information.
TCP/ETH	(if the option is available) Press the <I/O conf> key and select the configuration parameters (IP address, IP mask and IP gateway). See "Connection via the Ethernet interface" on page 9-2.
TCP/PPP	this function settle the communication between the hard disk of the OTDR and the PC via a modem. The WS-FTP PRO software (ref 5996/MTS) is used to download the data from the MTS^e to the PC. See the user manual of this software. The <Init Modem> key allows to initialize the modem connected to the MTS^e. See "Connection via a modem" on page 9-2.

On the Centronics line, choose the peripheral connected to the Centronics connector: printer or keyboard.

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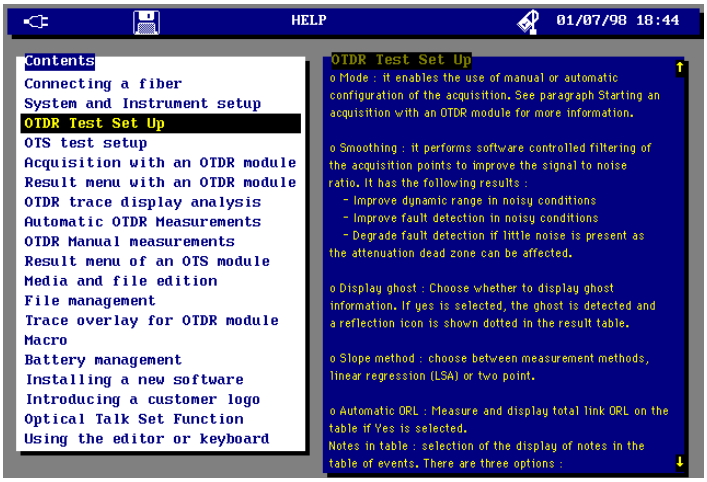
Help

The **HELP** key allows to access to an electronic manual :

1. a first press on the **HELP** key display the presentation and configuration of the MTS^e.
2. a second press on the **HELP** key calls the electronic manual.


HELP
01/07/98 18:44
Contents
Connecting a fiber
System and Instrument setup
OTDR Test Set Up
OTS test setup
Acquisition with an OTDR module
Result menu with an OTDR module
OTDR trace display analysis
Automatic OTDR Measurements
OTDR Manual measurements
Result menu of an OTS module
Media and file edition
File management
Trace overlay for OTDR module
Macro
Battery management
Installing a new software
Introducing a customer logo
Optical Talk Set Function
Using the editor or keyboard
OTDR Test Set Up
o Mode : it enables the use of manual or automatic configuration of the acquisition. See paragraph Starting an acquisition with an OTDR module for more information.
o Smoothing : it performs software controlled filtering of the acquisition points to improve the signal to noise ratio. It has the following results :
- Improve dynamic range in noisy conditions
- Improve fault detection in noisy conditions
- Degrade fault detection if little noise is present as the attenuation dead zone can be affected.
o Display ghost : Choose whether to display ghost information. If yes is selected, the ghost is detected and a reflection icon is shown dotted in the result table.
o Slope method : choose between measurement methods, linear regression (LSA) or two point.
o Automatic ORL : Measure and display total link ORL on the table if Yes is selected.
Notes in table : selection of the display of notes in the table of events. There are three options :

Help contents

- The left windows gives the list of the heading. Select the heading using the "↑" and "↓" directional arrows.
- The right window gives the contents of the selected rubric. To scroll this window, press the "→", then the "↑" and "↓" directional arrow.

Printing

To allow you to keep a copy of the results as a record, you can, at any moment, dump the display to:

- the internal printer (if version MTS 5200^e),
- an external printer
- or to a file that is stored on a floppy disk in the internal disk drive. To print stored files report to page 3-27.

You select where you require to print the data in the SYSTEM SETUP menu.

Copying to the internal printer

Use the following procedure to print on the internal printer of the MTS 5200^e:

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Attention

Make sure the printer has paper (see "Loading a new roll of paper" on page 3-26).

1. Press the **SETUP** key, then the <System setup> softkey and select the internal printer.
2. On the "Printer contents" line, select to print either only the trace or only the table, or both trace + table or the screen.
3. If the Screen option is selected, display the data you wish to print.
4. Press the **PRINT** key.

   The selected copy of the screen is printed.

Attention

If there is no print on the paper, check if the roll of paper has been placed in the printer on the right side (see page 3-26) as only one face of the thermal paper can be printed.

A header containing the mains acquisition parameters will be printed (see the following table).

Header

A header including the following informations is printed to the top of the copy .

Table 1: Example of header for OTDR results

Instrument parameters	
MTS 5200^e, 101, 1.27	Instrument used for the acquisition, serial number, software version.
Module: SI7926HD, 150,	Identification of the module installed in the OTDR during the acquisition (type, serial number).
File parameters	
Trace	Filename of the trace if it has been loaded from memory storage device.
Title	Title of the trace
Operator	Operator name
Cable Id.	Identification name for the cable
Origin location	Name entered for the origin of the fiber
End Location	Name entered for the end of the fiber
Direction	Direction of the measurement (origin to end or end to origin)
Acquisition parameters	
Measurement Date	Date and time the measurement was made
Laser	Wavelength of the laser used to make the measurement
Pulse	Pulsewidth used to make the measurement

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Table 1: Example of header for OTDR results

Range	Range used for the measurement
Resolution	Space between measurement points
Averaging	Number of seconds of averaging for the measurement
Fiber Number	Fiber number
Fiber parameters	
Index	Index of the fiber
Scatter Coeff.	Back scattering coefficient of the fiber
Result parameters	
Splice Threshold	Threshold for splice display.
Reflec. Threshold	Threshold for reflective event display.
Slope Threshold	Threshold used to display the slope.
Display Ghosts	Selection of ghost display.
Fiber End Threshold	Threshold used to detect the end of the fiber.
Launch cable	Location of the end of launch cable (see page 5-4)

Table 2: Example of header for WDM results

Instrument parameters	
MTS 5200^e, 865, 3.22	Instrument used for the acquisition, serial number, software version.
Module: 5071 WDM, 280,	Identification of the module (type, serial number).
File parameters	
Trace	Filename of the trace if it has been loaded from memory storage device.
Title	Title of the trace
Operator	Operator name
Cable Id.	Identification name for the cable
Origin	Name entered for the origin of the fiber
End	Name entered for the end of the fiber
Test point	Identification name for the test point
Fiber number	
Comments	
Acquisition parameters	
Measurement Date	Date and time the measurement was made
Laser	Wavelength of the laser used to make the measurement

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Table 2: Example of header for WDM results

Frequency	Frequency range in THz
Resolution	Filter resolution
Averaging	Number of seconds of averaging for the measurement
Threshold	Threshold used to detect the channels
S/N Distance	Distance between the channel peak and the reference point for the noise
Noise Acqu BW	Reference bandwidth used for noise acquisition
High sensitivity	Power scale range
Channel detection	Detection reference

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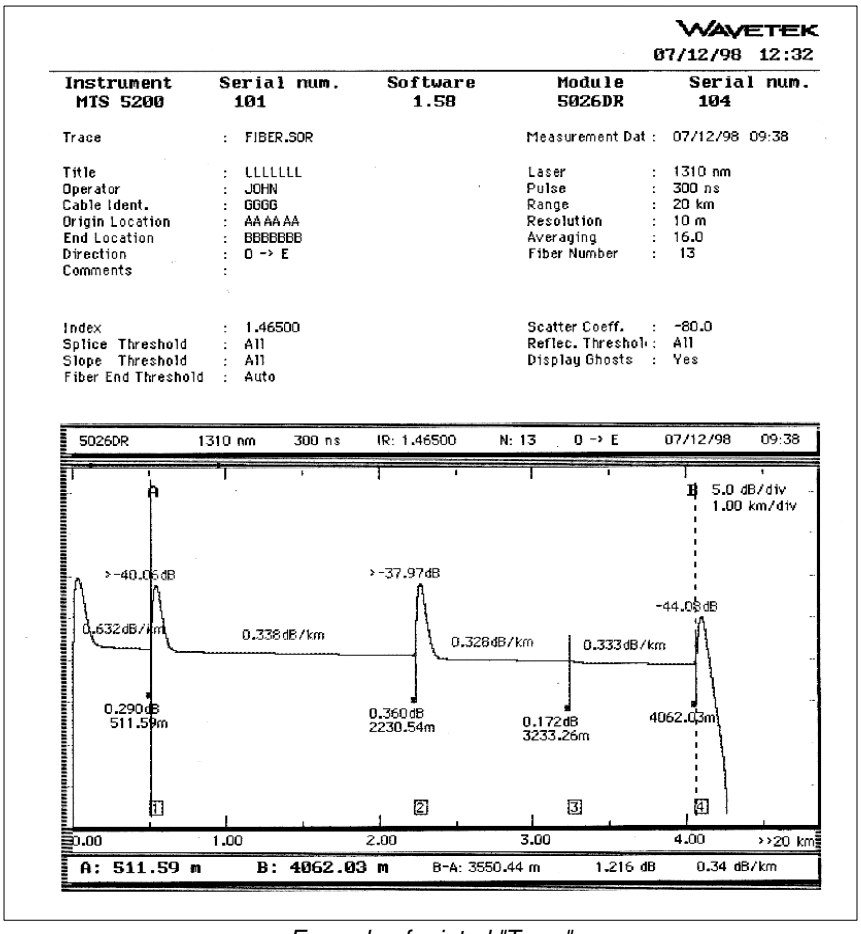
Examples of OTDR print out

The following examples concern the 4 possibilities given in the menu <System setup>, on the line Printer/Print Contents: print of the trace only, the table only, the trace and the table, the screen.



Example of printed "Trace"

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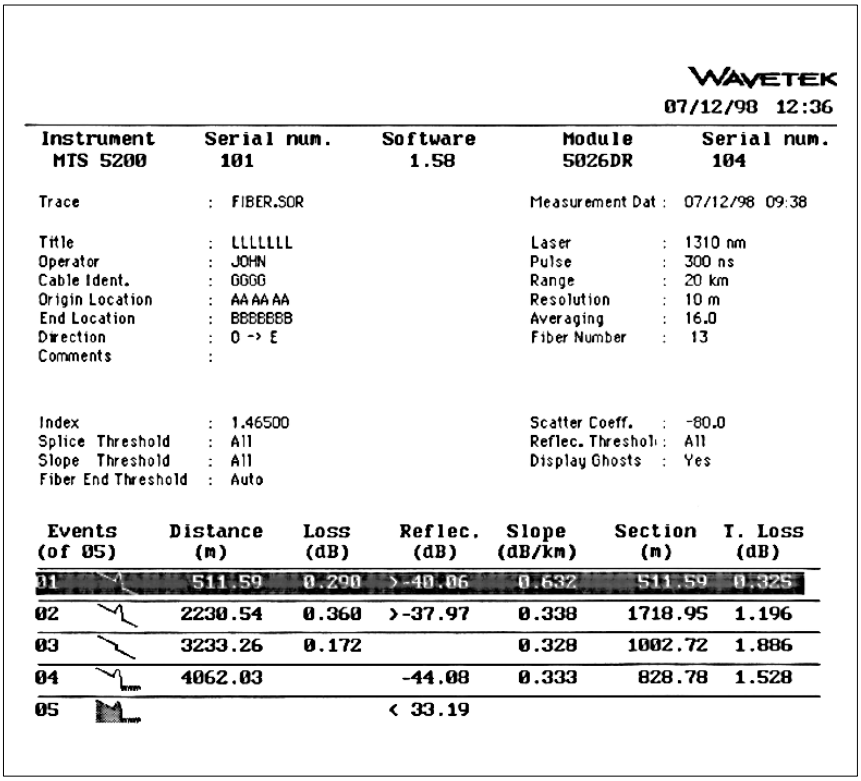

WAVETEK

07/12/98 12:36

Instrument	Serial num.	Software	Module	Serial num.
MTS 5200	101	1.58	5026DR	104

Trace	:	FIBER.SOR	Measurement Dat	:	07/12/98 09:38
Title	:	LLLLLLL	Laser	:	1310 nm
Operator	:	JOHN	Pulse	:	300 ns
Cable Ident.	:	GGGG	Range	:	20 km
Origin Location	:	AA AA AA	Resolution	:	10 m
End Location	:	BBBBBBB	Averaging	:	16.0
Direction	:	0 -> E	Fiber Number	:	13
Comments	:				
Index	:	1.46500	Scatter Coeff.	:	-80.0
Splice Threshold	:	All	Reflec. Threshol	:	All
Slope Threshold	:	All	Display Ghosts	:	Yes
Fiber End Threshold	:	Auto			

Events (of 05)	Distance (m)	Loss (dB)	Reflec. (dB)	Slope (dB/km)	Section (m)	T. Loss (dB)
01	511.59	0.290	>-40.06	0.632	511.59	0.325
02	2230.54	0.360	>-37.97	0.338	1718.95	1.196
03	3233.26	0.172		0.328	1002.72	1.886
04	4062.03		-44.08	0.333	828.78	1.528
05			< 33.19			

Example of printed "Table"

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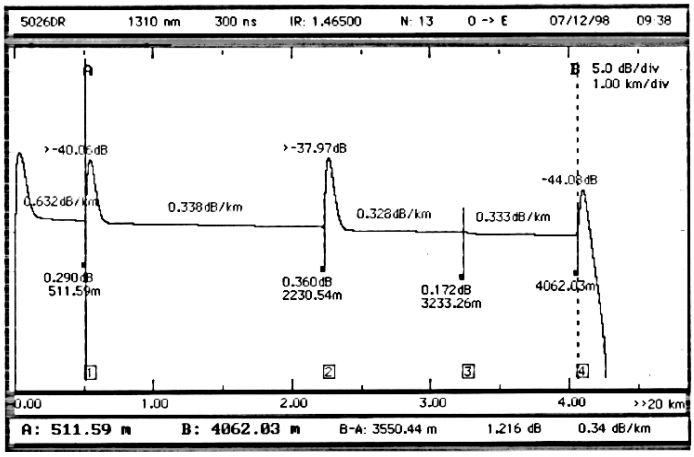
WAVETEK
07/12/98 12:34

Instrument	Serial num.	Software	Module	Serial num.
MTS 5200	101	1.58	5026DR	104

Trace	: FIBER.SOR		Measurement Dat	:	07/12/98 09:38
Title	: LLLLLLL		Laser	:	1310 nm
Operator	: JOHN		Pulse	:	300 ns
Cable Ident.	: GGGG		Range	:	20 km
Origin Location	: AAAAAA		Resolution	:	10 m
End Location	: BBBBBBB		Averaging	:	16.0
Direction	: O -> E		Fiber Number	:	13
Comments	:				
Index	: 1.46500		Scatter Coeff.	:	-80.0
Splice Threshold	: All		Reflec. Threshol	:	All
Slope Threshold	: All		Display Ghosts	:	Yes
Fiber End Threshold	: Auto				



WAVETEK
07/12/98 12:34

Events (of 05)	Distance (m)	Loss (dB)	Reflec. (dB)	Slope (dB/km)	Section (m)	T. Loss (dB)
01	511.59	0.290	>-40.06	0.632	511.59	0.325
02	2230.54	0.360	>-37.97	0.338	1718.95	1.196
03	3233.26	0.172		0.328	1002.72	1.886
04	4062.03		-44.08	0.333	828.78	1.528
05			< 33.19			

Example of printed "Trace + Table"

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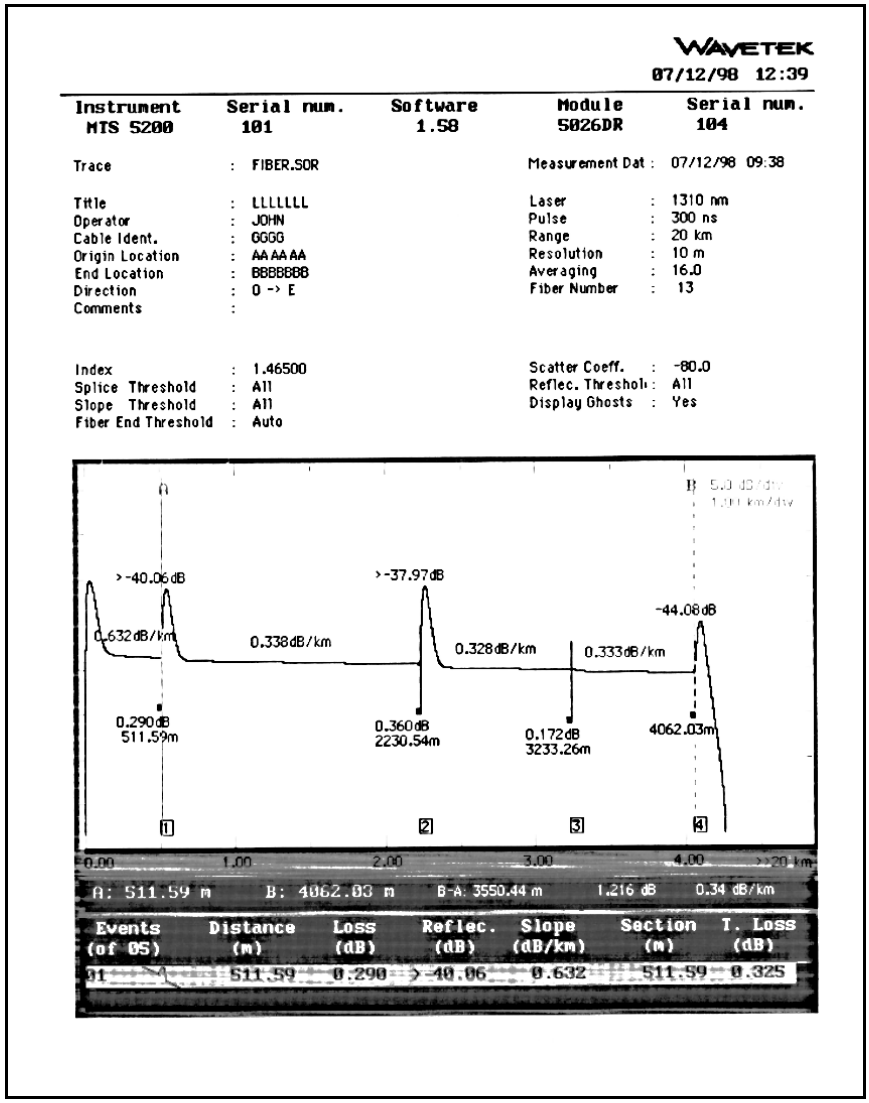

Example of hardcopy

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Loading a new roll of paper

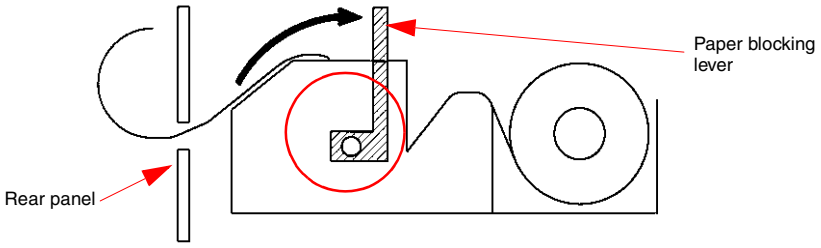
Attention

The paper rolls must be stored in a cool, dry and shaded place.
see reference on page 11-7.

An internal device detects the end of the roll and triggers display of "No paper". Also a red line is marked on the paper, beginning approximately 1 meter from the end of the roll.

- On any new roll of paper remove the adhesive and cut back at least one turn of paper from the beginning of the roll to eliminate all traces of glue which could damage the print head.
- Remove the protective cover of the printer below the instrument by undoing the two thumbscrews.

  The paper feed path, marked on the printer itself, is given below:



Paper feed path

- Push the lever up
- Position the new roll of paper and feed the paper by hand following the path indicated below, until it comes out of the rear panel.
- Push the lever down.
- Reposition the printer cover and secure it by tightening the two thumbscrews.

Coping to an external printer

To do this you must first connect a compatible printer to the Centronics connector on the rear panel of the MTS^e.

External Printer configuration

Use the following procedure to set the correct printer configuration. In the *SYSTEM SETUP* menu:

1. Select the option External in the Printer windows.
2. Select the printer used on the line Printer type : see "Choice of the external printer type" on page 3-16.

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3. On the Printer contents line, select to print either the trace, or the table, or both trace + table or to make an hardcopy of the screen.
4. In the I/O interface windows, line Centronics, select the Printer option.

Printing on an external printer

Use the following procedure to print on an external printer:

1. Display the data you wish to print on the screen.
2. Press the PRINT key.

   The selected copy of the screen is printed on the external printer. The same header as for the internal printer is printed (see "Header" on page 3-19).

Copying to a file on a floppy disk

You can dump the displayed screen as a graphic file to include it in reports using many popular desktop publishing software packages.

Use the following procedure to copy to a file on a floppy disk:

Attention

Make sure *FILE* is selected for *PRINTER* in the *SYSTEM SETUP* menu (see "Choice of printer" on page 3-16).

Use the following procedure to copy to a file on a floppy disk:

1. Press the FILE key and select the Media : Floppy disk, the File naming: Manual or Auto (see "Filename" on page 8-2), and the file format (see "File format" on page 8-11).
2. Display the screen you wish to copy.
3. Press the PRINT key.

   A copy of the screen is saved on the floppy disk in the selected format and with the selected file name.

Attention

If you create several consecutive files on the same disk you must enter a new name before each press of print or the same file will be used and its contents replaced each time. Only the last screen copied is saved if you do not change or increment the file name each time.

Visual fault locator function

This VFL option available in the OTDR module, allows transmission of a visible red light (continuous or at 1 Hz) in a fiber, in order to find faults in the OTDR deadzone or to identify fibers.

When the VFL function is selected in the Instrument Setup menu, a softkey allows the choice between the CW or 1 Hz transmission.

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Optical Talk Set Function

This function is available as an option with the OTS modules. It consists of a headset and microphone.

It allows two users situated at each extremity of an optical link to communicate. Each extremity of the link must be equipped with a combined Laser source/ Power meter:

- two MTS^e, each equipped with an OTS module with the Talk Set option.
- an MTS^e (equipped with an OTS module with the Talk Set option) and an OTS type 7940X (with Talk Set option).

The Talk Set function can be in three states:

- not selected (the icon shaded).
- selected but not active (icon light with headset light): the standby mode, ready to receive a transmission.
- selected and active (icon light with headset dark): communication has been established.

Establishing communication

1. At each extremity of the fiber:

- Connect the Laser source of one of the OTS to the Power meter of the other and vice versa, with the aid of two jumpers or two optical links.
- Plug the headset plug into the corresponding socket on the rear panel of the OTS module.

2. If the instrument calling is an MTS^e, press the **SET-UP** key and validate the Talk Set function from the Instrument Configuration menu (see page 3-12).

- the Talk Set icon becomes light with the headset light.
- The icon appears at the top of the screen.
- A message is sent to the other extremity of the fiber and an audio signal is given from the receiving instrument.

3. If remote instrument is ready to receive a communication (in standby), it transmits a validation signal to the calling instrument.

- The MTS^e Talk Set icon becomes light with the headset dark.
- Telephonic communication can be established.
- Press the <Talk Set> then the <Volume ++> or <Volume - -> keys to adjust the earpiece output level.

4. If the remote instrument is not ready to receive a communication (Talk Set function not validated): the icon remains light with the headset light. It becomes light with the headset dark as soon as the correspondent calls.

5. At the end of the communication, on the MTS^e, press the <Select> key to disable the Talk Set function. The icon is displayed shaded.

Note

The Talk Set function can be used during OTDR measurements. If this function is validated at the same time as the OTDR module, it is possible to call a correspondent during an acquisition.

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Specific key functions when the Talk Set is active

Pressing the <Talk Set> key calls the following keys:

<Com. Laser> Toggles the transmitted signal wavelength between 1550 and 1310 nm. This key is also available in the standby state. A 1550 nm wave length provides communication of greater distances than a 1310 nm wavelength.

<Volume ++> and <Volume - - >
Adjust the ear piece volume.

<Ringing> Causes an audio signal to be transmitted from the distant instrument with which you wish to establish communication.

<EXIT> Returns to the configuration keys.

Introducing a user logo

The Wavetek logo that appears by default in the help windows and in the headers of printouts can be replaced with the user's logo.

Conditions

Dimensions of user's logo

The user's logo must have the following dimensions:

Height ≤ 40 pixels

Width ≤ 400 pixels (this dimension must be a multiple of 8)

Height x width ≤ 8000

Format of user's logo

Bitmap 16 colors.

Configuration of MTS^e

The MTS^e must be equipped with a floppy disk drive.

Method of integrating a logo

On the PC, using a "Paint" type drawing application:

- create a file at the dimensions of the new logo. Modify it if necessary to meet the conditions above.
- save the file as a bmp format file, type "Bitmap 16 colors".
- copy the logo file onto the floppy disk

On the MTS^e :

- insert the floppy disk
- press the **FILE** key and find the file corresponding to the logo (see "Finding files" on page 8-18).
- press the <Load logo> key.

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- the new logo appears on the screen: it will now replace the previous logo on the help pages obtained by pressing the **HELP** button. It will also be present in headers of the printouts.

Note

It is possible that the colors selected on the PC are not the colors displayed on the MTS^e. It is then recommended to integrate a logo in black & white.

Troubleshooting

Nothing happens when the ON/OFF switch is pressed.

Make sure that the internal battery is installed or that the mains adapter is connected.

You are using the MTS^e normally when it suddenly switches off.

The instrument may be configured to automatically switch off after five minutes of inactivity to preserve battery life (see "Auto off" on page 3-14).

The MTS^e injection level indicator shows a bad connection.

Clean the MTS^e optical socket with dry air.
Clean the input connector of the fiber under test.

The charge is not working (i.e. the charge LED does not switch on when the unit is AC powered and is off.

There is no battery in the unit or the battery has a good level of charge.

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Chapter 4

MTS^e Controls

This chapter describes the MTS^e commands:

- ❏ Front panel commands: buttons, softkeys, screen, etc …
- ❏ Rear panel commands: connectors (power, RS 232, Centronics), disk drive, optical connector.

Note

The MTS^e is a multi-tasking instrument: the user can simultaneously make an acquisition, modify the configuration parameters, print the results and access an internal memory directory or floppy disk directory.

Front panel

The MTS^e front panel contains the controls, display and the indications necessary to analyze the measurement:

- the display and, to the right, the associated softkeys.
- the **ON/OFF** switch and the **On** and battery **charge** leds.
- the direct access keys:

  HELP to call the on-line help pages,

  PRINT for all printing operations,

  FILE for all file storage and management,

  START/STOP to execution measurements, and the "**Run**" indicator to show that a measurement is underway,

  RESULTS for all measurement analysis operations
- the **Run** led flashing when the laser is on.
- directional arrow keys .

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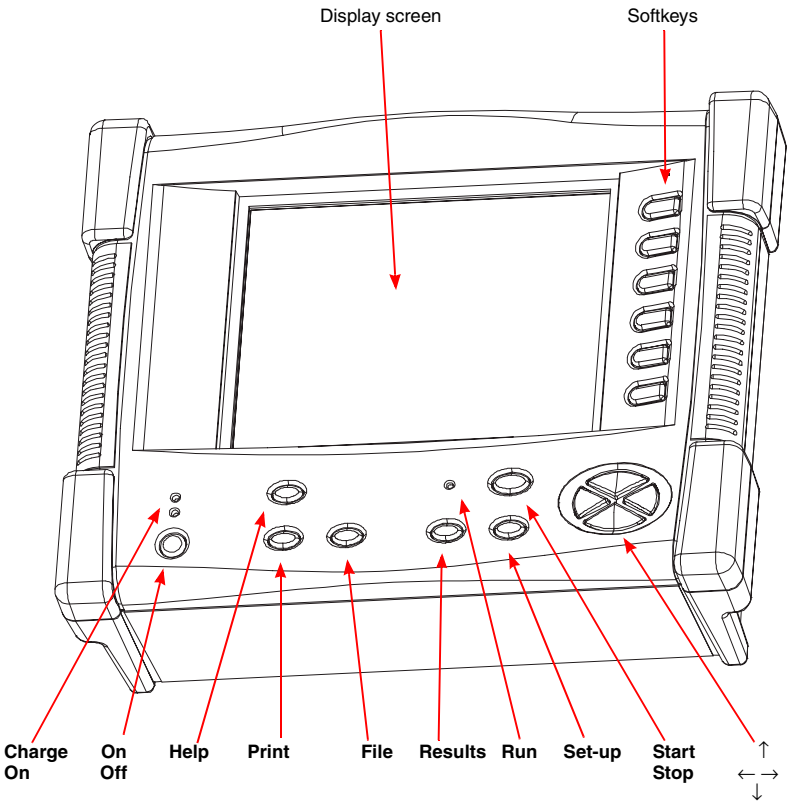

Front Panel

Display screen and softkeys

The MTS^{e} is equipped with a large display screen that provides excellent resolution and that can also be backlit:

- either an 8.4 inch TFT color screen (option 5000/COL)
- or an 8 inch passive color (option 5000/PAS) or B/W screen with adjustable contrast.

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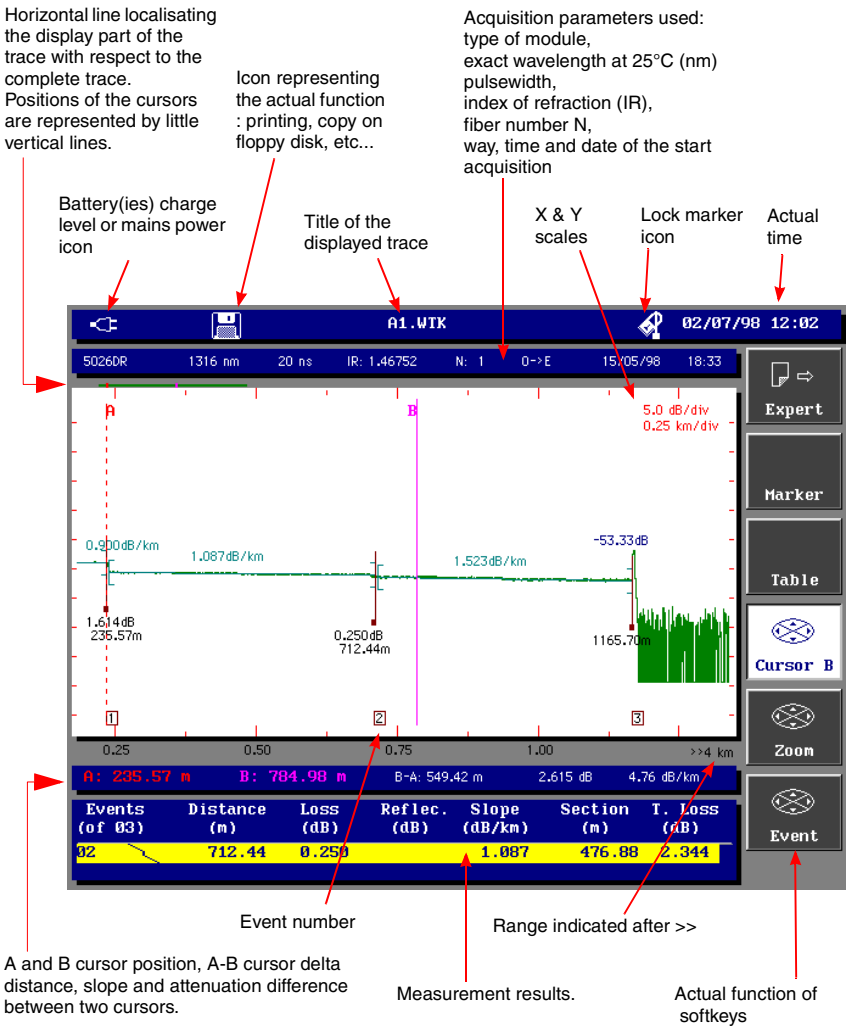
Horizontal line localisating the display part of the trace with respect to the complete trace. Positions of the cursors are represented by little vertical lines.
Icon representing the actual function : printing, copy on floppy disk, etc...
Acquisition parameters used: type of module, exact wavelength at 25°C (nm) pulsewidth, index of refraction (IR), fiber number N, way, time and date of the start acquisition
Battery(ies) charge level or mains power icon
Title of the displayed trace
X & Y scales
Lock marker icon
Actual time
A1.WTK
02/07/98 12:02
5026DR 1316 nm 20 ns IR: 1.46752 N: 1 0->E 15/05/98 18:33
5.0 dB/div
0.25 km/div
0.200dB/km
1.087dB/km
1.523dB/km
-53.33dB
1.614dB
235.57m
0.250dB
712.44m
1165.70m
0.25 0.50 0.75 1.00 >>4 km
A: 235.57 m B: 784.98 m B-A: 549.42 m 2.615 dB 4.76 dB/km
Events (of 03) Distance (m) Loss (dB) Reflec. (dB) Slope (dB/km) Section (m) T. Loss (dB)
02 712.44 0.250 1.087 476.88 2.344
Expert
Marker
Table
Cursor B
Zoom
Event
Event number
Range indicated after >>
A and B cursor position, A-B cursor delta distance, slope and attenuation difference between two cursors.
Measurement results.
Actual function of softkeys

Example of OTDR trace display results

Any operation or programming errors are signaled by a message on the screen. Help information can be called at any time by pressing the **HELP** key.

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Directional arrow keys

The directional arrow keys have two principle functions:

- on the result page, they are used to position zoom and move the cursor.
- on the setup pages, they are used to scroll though the menus.

Control keys

The six keys on the screen provide the following functions:

START STOP This START STOP key has two functions. With OTDR module:

- The START function starts an acquisition in accordance with the chosen parameters. When the key is pressed and held a real time acquisition is made. The red "RUN" indicator flashes during the measurement. The results of the measurement are displayed on the screen at the end of the acquisition.

- The STOP function interrupts the acquisition underway.

SET-UP The **SET-UP** key calls a menu which provides access to the following configuration options:

- Test Set up to configure the measurement parameters.

- System Set up to configure the system parameters (display, date, language, printing, etc …).

- Instrument Set up to configure the instrument (choice of the module or modules to use).

RESULTS The **RESULTS** key displays the result (OTDR trace or table) and allows the measurement to be analyzed.

FILE The **FILE** key calls the file management menu to save, recall or delete files from the internal storage media (SRAM or hard disk) or the floppy disk.

PRINT The Print key starts a printout of the screen or the chosen selection on the printer configured for the instrument.

HELP Calls the Welcome page giving the main possible actions. A second press on this key calls the electronic manual (see "Help" on page 3-18)

Laser activity indicator

The red LED **Run** flashes the laser is transmitting.

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Configuration menus

- All the configuration menus are accessible from one another by pressing on the corresponding key.
- The configuration menu can be displayed and modified during an acquisition or measurement. The parameters that cannot be modified are dimmed. The menu provides all the possible options with the exception of the numerical values.
- To move from one parameter to another use the "↑" and "↓" directional arrows. Once a parameter is selected its values are displayed to the right of the parameter.
- To modify the value of a parameter, use the "<" and ">" directional arrows to highlight the option chosen.
- A message at the bottom of the screen indicates how to modify the parameter.
- To leave a configuration menu, the user can press any of the keys located below the screen or the <EXIT> softkey.

Editing[1]

In the configuration menus it is sometimes necessary to enter alpha-numeric information for names of files, results or for remarks.

To call the following menu, press the <EDIT> key.

1. When an external keyboard is used (see "Use of the external keyboard" on page 4-7)

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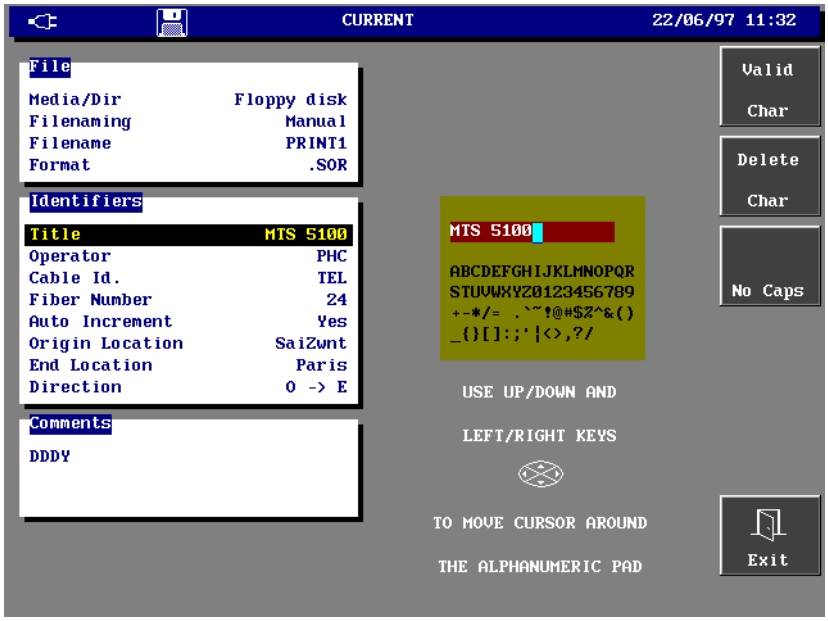

Edition menu

This menu contains:

- in the central window, the list of characters available (which can be understood by the DOS system) and, in the upper part of this window, the text to modify or the text that is being entered.
- on the left side, the keys:

  <Valid. Char.> to select the character under the cursor.

  <Delete Char.> to delete the character under the cursor.

  <No Caps/Caps> to change the chosen characters from uppercase to lowercase and vice versa.
- on the word, an underscore indicates what character is selected.

To enter text:

- Press the <No Caps/Caps> key, to change the characters proposed from uppercase to lowercase and vice versa if necessary. This option is not valid for the file name which are always in capital letters.
- Using the directional arrows position the cursor on the first letter required.
- Press the <Valid. Char.> key.
- The character appears in the upper frame.
- Repeat the above steps for the following characters

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To delete a character in a text:

- Position the cursor on the character
- Press the <Del Char.> key
  Repeatedly pressing this key deletes the proceeding characters.

To insert characters in the text:

- Position the cursor on the character proceeding the point you want to enter text.
- Position the cursor on the character you want to insert.
- Press the <Valid. Char.> key
- Repeat the above steps to insert the following characters.

Leaving the Edit menu

- Press the <Exit> key or any hard key.

Note

If a file name is being edited only valid DOS characters are accepted.

Use of the external keyboard

The external keyboard (option 5000/keyb) facilitates data entry for set up, file naming and comments, and for remarks in the table of results.

Keyboard connection

- Connect the keyboard to the Centronics connector of the MTS^e.
- Using the **SET UP** / **System Setup** keys, access the Interface I/O setup menu.
- On line Centronics, choose the option Keyboard.

Note

The keyboard must be connected to the MTS^e before selection in the menu.

If the keyboard is used, it is not possible to use an external printer.

Equivalence between external keyboard and MTS^e keyboard

Althrough the external keyboard is mainly intended to stand in for the MTS^e editing menu, it can replace all the MTS^e keys except the **ON/OFF** key.

- Softkeys at the right side of the screen are replaced by the function keys **F1** to **F6**.
- Hard keys below the screen are equivalent at **Ctrl** followed by the first character of the key (except for the **Setup** key equivalent to **Ctrl U)**.
- The arrow keys have the same function on the external keyboard and on the MTS^e (except for the comment edition in the File menu).

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Editing a text from the external keyboard

Function	External keyboard
Help	Ctrl + H
Print	Ctrl + P
File	Ctrl + F
Results	Ctrl + R
Start/Stop	Ctrl + S
Set-Up	Ctrl + U
← ↑ → ↓	← ↑ → ↓
Softkey 1 to 6 (from top to bottom)	F1 → F6
Exit	Enter
Abort	Escape

To edit a title or an identification in the setup menu or a remark in the table of results, using the external keyboard :

- press **Enter** to open the edition menu.
- enter the text
- press **Enter** to quit the editing menu
- The ESC key allows to quit the editing menu without recording the text

Edition of a comment in the File menu

- Move down the cursor to the Comments windows
- Press enter to open the Edition menu
- edit the text (3 lines of 18 characters max.)
- press enter to go to the next line
- use the ↑ and ↓ keys to go from on line to the next or the preceding
- on the third line, press enter to quit the editing menu and store the text.
- Press the Esc key to quit the editing menu without storing the text.

Rear panel

The rear panel contains the following elements:

- the mains power adapter socket for charging the batteries,
- the floppy disk drive (optional)
- the RS 232 connector
- the Centronics connector for the external printer or keyboard connection
- the optical module or modules

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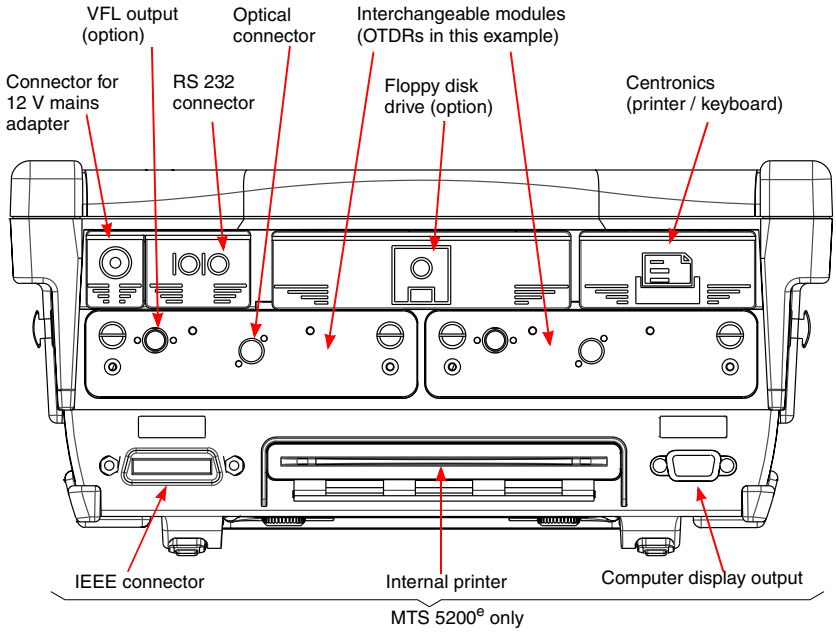
On the MTS 5200^e only, if the corresponding options are present :

- the internal printer
- the connector IEEE



Example of rear panel configuration
(MTS 5200^e with IEEE and internal printer options)

Fiber connector

The optical connector is used to connect the MTS^e to the fiber you wish to test. The connector is protected with a dust cap which should remain in place when the fiber is not connected.

Floppy disk drive (option)

The floppy disk drive is a 3.5 inch, 1,44 Mb, high density (HD), MSDOS format unit.

The floppy disk drive enables:

- the installation of new MTS^e software versions.
- the storage of trace and measurement result files for use at a later date.

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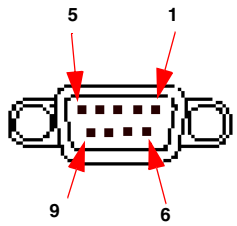
Serial port (RS 232)

A 9 pin serial connector (RS232 DTE) allows a direct connection to a modem for programmed operation.



Port RS232

MTS^e pin	Function	Input/output
1	DCD	←
2	RxD	←
3	TxD	→
4	DTR	→
5	GND	→
6	DSR	←
7	RTS	→
8	CTS	←
9		

Attention

In the case of a connection to a computer (PC for example) which has also a DTE behavior, use a cord inverting pins 2 and 3, 4 and 5, 8 and 9.
It can be necessary to use a male/femelle adapter.

Parallel port (Centronics)

25 pin connector (Centronics) allowing the connection of an external centronics printer or a keyboard.

MTS^e pin	Printer pin	Line name
1	1	STROBE
2	2	Do
3	2	D1
4	2	D2
5	2	D3
6	2	D4
7	2	D5
8	2	D6
9	2	D7
10	10	ACK
11	11	BUSY
12	12	PE
13	13	SLCT
14	14	AUTO FEED
15	32	-ERROR
16	31	INIT
17	36	SLCT IN
18-25	19-31	GND

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IEEE port

Optional, for MTS 5200^e mainframe only: 24 pin parallel port allowing the connection to a controller.

Reference of the option: 5200/IEEE.

Computer display output

Optional, for MTS 5200^e mainframe with color TFT display only: 15 pin port allowing the connection to a projector or a monitor.

Reference of the option: 5200/VGA

When a monitor or a projector is connected, press the key <VGA> in the menu **SET-UP** / System Setup to switch to the VGA display.

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Chapter 5

Using an OTDR module

This chapter describes the different steps required to make a measurement:

- ❏ The configuration of the acquisition (manual, auto, etc.) and the acquisition parameters.
- ❏ The choice of the results to display.
- ❏ The start of measurement (acquisition)
- ❏ The analysis of the results (events, table of results).
- ❏ Automatic measurements (detection and measurement).
- ❏ Semi-automatic measurements (by addition of markers)
- ❏ Manual measurements.
- ❏ Both end measurements.
- ❏ Fault locator mode
- ❏ Macro.

OTDR Test SET-UP*

To set up the OTDR and then make a measurement of the fiber under test the following parameters need to be configured:

- ❏ **Acquisition parameters**: Laser wavelength, Acquisition mode, Pulsewidth, Range, Acquisition time, Resolution.
  All these parameters are configured from the Acquisition menu of the OTDR Test Setup window.
- ❏ **Measurement result display parameters**: Splice threshold, Reflectance threshold, Slope threshold, Display ghosts, Slope measurement method, Display results on trace (with or without launch cable), Display notes in table.
  All these parameters are configured from the Result menu of the OTDR TEST SETUP window.
- ❏ **Fiber parameters**: Wavelength, Reflective Index, Section A_B, Backscattering coefficient.
  All these parameters are configured from the Fiber Parameters menu of the OTDR TEST SETUP window.
- ❏ **Trace identification information**: Trace Title, Operator name, Cable identifier, Fiber number, File number auto-incrementing, Origin location, End location, Measurement direction.

*. if an OTDR module is installed

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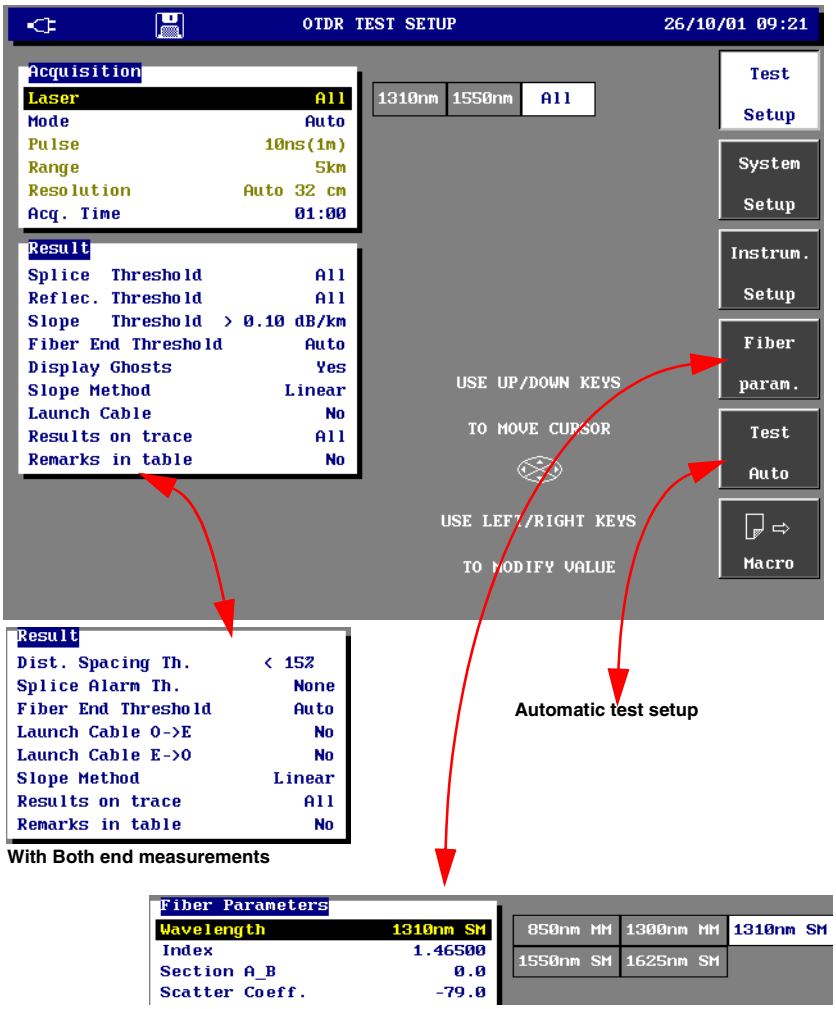
All these parameters are configured from the Identifiers menu of the File Manager window and can be entered before or after the acquisition.

To select the required acquisition, you must call the OTDR TEST SETUP window measurement result display parameters and fiber parameters, pressing the <**SET-UP**> button. If either the SYSTEM or INSTRUMENT SETUP windows are already displayed press directly the <Test Setup> key.



OTDR TEST SETUP window

In these windows, the selected parameter is high-lighted or in a different color. Select this parameter using the ↓ and ↑ directional arrows.

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The available choices are displayed on the screen; these depend on the chosen function. Make the required choice with the ← and → directional arrows.

Selecting measurement acquisition parameters

You can choose the following measurement acquisition parameters, from the Acquisition menu of the ODTR TEST SETUP window, regardless of the type of measurement made on the trace:

Laser	Choose the wavelength for multi-lambda modules: the values provided depend on the modules installed. All: each acquisition is made on all the available wavelengths.
Mode	Choose the acquisition mode: Manual. Auto: the unit will automatically configure the best acquisition parameters according to the fiber under test.
Pulse	Depending on the modules. See Technical specifications chapter 9.
Range	Depending on the modules. See Technical specifications chapter 9. The range you can select depends on the pulse width you select. The range values you can select for each pulsewidth are given in section "Ranges" on page 11-13.
Resolution	from 4 cm to 160 m according to the module. No measurement sampling. The available values depend on the Range and on the Acq. time selected. AUTO : the resolution is automatically chosen depending on the Range and Acq. time parameters.
Acq. Time	From 5 s. to 10 mn This acquisition period is used for real time or averaged acquisition. For example, if 1 minute is selected and a real time acquisition is performed, the real time period will be 1 minute.

Test Auto

The key <Test Auto> sets the following parameters:

- Acquisition parameters

Laser	All
Mode	Auto
Resolution	Auto

- File parameters (see page 8-1)

Autostore	Yes
Fiber Num Increment	Yes
File naming	Auto

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Selecting measurement result display parameters

You can choose the following measurement result display parameters from the Result menu of the OTDR TEST SETUP window:

Splice threshold: Selection between: ALL, NONE or any value in dB between 0 and 6.00 in 0.01 dB steps.
Factory default value: ALL

Reflec. threshold: Selection between: ALL, NONE or any value in dB between -11 and -99 in 1 dB steps.
Factory default value: ALL

Slope threshold: Selection between: ALL, NONE or any value in dB/km between 0 and 2.00 in 0.01 dB/km steps.
Factory default value: >0.10 dB/km

Note If after a measurement, no results are displayed on the trace, make sure that the ALL parameter has been selected in the display options.

Fiber end threshold: It is advised to choose the AUTO option (factory default option) for which the end of fiber is automatically detected. The MANUAL option allows to select a specific threshold for the fiber end detection, from 3 to 15 dB using the «<« and «>» arrows keys.

Display Ghosts: Choose whether (yes or no) to display ghost informations. If ghosts are displayed: the reflection icon is shown dotted in the result table, the reflection value is shown between parentheses on the trace; e.g. "(R:-50dB)".
Factory default value: yes.

Note Ghosts are only detected during an automatic measurement.

Slope Method: Choose between measurement methods: linear regression (LSA) or two point.
Factory default value: LSA

Launch Cable: Choose to display in the event table, the results referenced to the launch cable.
- No: all the results are displayed and the reference is the origin of the fiber.
- Marker 1, 2 or 3: results are referenced from the marker (1, 2 or 3 selected using the «<« end and «>» keys). This marker is considered as the «end of launch cable" and is the reference for loss and distance measurements.
Factory default value: No.

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Results on trace	Choose to display: None: the trace only All: the trace with results and markers Graphics only: the trace with markers only. Factory default value: All.
Remarks in table	Selection of the display of notes in the table (see "Notes in table" on page 5-19) None: no additional display Note: display of notes entered by the user Uncertainties: displaying of notes entered by the user and confidence indicators for the result measurements. Factory default value: None.

To call the factory default values of the Results parameters, press the <Factory Default> softkey.

Selecting measurement result display parameters for both end measurement

In the case of both end measurements (see "OTDR TEST SETUP window" on page 5-2 :

- some parameters are not available. They are replaced with:

Dist. Spacing Th.	Selection of the distance spacing threshold between two markers (one on the E-O trace, the other on the O-E trace). If their spacing exceeds the threshold, the markers are considered as referring to separate events. This threshold is expressed in percentage of the length of the section before the event.
Splice Alarm Th.	Selection of the splice alarm threshold. If the average loss results exceeds this threshold, it will be displayed in red in the table of results.

- The parameter Launch Cable is replaced by the two parameters Launch Cable O-> E and Launch Cable E -> O allowing to choose a marker End of fiber for each direction.

Selecting fiber parameters

You can choose the following fiber parameters from the Fiber Parameters menu of the OTDR TEST SETUP window:

Wavelength:	Choose the type of fiber wavelength for which the fiber parameters will be defined from the following values:, 850 nm MM, 1300 nm MM, 1310 nm SM, 1550 nm SM and 1625 nm SM
Index:	Choose the group index N of the total fiber. Selecting a given index will modify the A_B distance. - either select the index from 1.30000 to 1.70000 using the "<" and ">" arrows keys.

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- or select a predefined value : press the <Preset Index> softkey and select (using the «<«and «>» arrows keys) one of the cable. See in the following table the index for each cable type. Once a cable has been selected, press the <Confirm Index> softkey to validate it.

Wavelength (nm)	850	1300	1310	1550	1625
Corning 62.5/125	1.50140	1.49660			
Corning 50/125	1.48970	1.48560			
SpecTran 62.5/ 125	1.49600	1.49100			
Litespec			1.46600	1.46700	1.46700
SpecTran SM			1.46750	1.46810	1.46810
Lucent Truewave			1.47380	1.47320	1.47320
Fitel (Furukawa)			1.47000	1.47000	1.47000
Corning SMF-LS			1.47100	1.47000	1.47000
Corning SMF-DS			1.47180	1.47110	1.47110
Corning LEAF			1.46890	1.46840	1.46840
Corning SMF-28			1.46750	1.46810	1.46810
ATT SM			1.46600	1.46700	1.46700

Preset index values

Section A_B: Enable the index N calibration, the distance between the cursors A and B being known. Selecting this known distance will display the index of the fiber. The limits of the distance are given by the index (1.30000 to 1.70000).

Scatter Coeff.: Choose the backscattered coefficient K from -99 dB to -50 dB in 0.1 dB steps. Modification of K modifies the reflectance and ORL measurements. The default values are given in "Reflectance" on page 1-2.

Acquisition

The MTS^e provides three distinct methods of making an acquisition:

- A real-time mode, when the MTS^e makes up to 10 acquisitions per second and displays the resulting trace on the screen along with a connection status indicator.
- A rapid automatic mode that allows you to make an acquisition with an automatic configuration process using the minimum of key strokes.

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❏ A manual acquisition mode that lets you configure your acquisition parameters exactly for the fiber you wish to test.

After any acquisition (except in real time mode), an automatic measurement is performed.

With multi-wavelength modules, the acquisition can be started automatically on all the wavelenghts, each time the **START** button is pushed.

Note For battery operation, the module will go into sleep mode if no acquisition is made within two minutes. A message "powering up in process" appears for few seconds at the next acquisition.

The presence of traffic in the fiber under test is automatically detected (see "Detection of traffic" on page 5-13.

Real-time mode

To make an acquisition in real-time mode you must first configure all the acquisition parameters you require and then press and hold the START STOP key for more than one second.

A real-time mode acquisition cannot be used to make accurate measurements, because of the high noise level, but is invaluable for quickly optimizing the connections and observing the fiber while it is being manipulated.

1. Use the following procedure to configure the acquisition parameters you require for the fiber and the test:

- Either select the Acquisition parameters you require in the OTDR TEST SETUP window (see "Manual acquisition mode" on page 5-11).
- Or press the **SET-UP** button to have a direct access to:
  - the parameters : wavelength, pulse, range, resolution.
  - the change to average mode.

2. Press and hold for more than one second the **START STOP** key to start the real-time acquisition.

   The red **RUN** LED comes on to indicate a real-time acquisition is underway and the screen shows the acquired trace in real-time mode. A connection condition indicator is also displayed on the screen to indicate the status of the fiber connection, GOOD or BAD.

Note If the connection is not good, verify and clean the connector.

Note A message "Low injection level, check your connection" is displayed in real time/ average mode, when the injection level measured is lower than a third of the max. level.

Connection quality indicator

The connection quality indicator readings provide the following connection status information:

Status	Connection condition
Good	A good connection.

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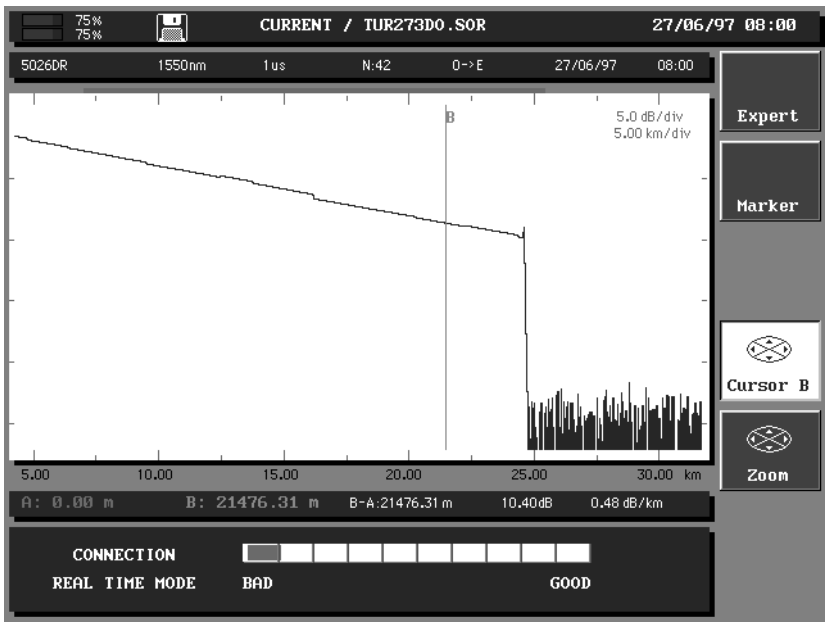
Status	Connection condition
Bad	Indicates one of the following cases: There are several connectors close to the front end connector. One of the connectors is dirty or badly connected. You must re-connect or change the pigtail. There is no fiber connected.

For a bad connection condition you can make measurements but very poor detection results should be expected.

Real-time display

The following illustration shows an example of an acquired trace in real-time mode.



Acquired trace in real-time mode

To stop or interrupt the real-time mode acquisition, press the **START STOP** key a second time.

While the MTS^e is operating in real-time mode, you cannot modify any of the acquisition parameters, the wavelength or select an overlay trace.

You can only make reference and cursor measurements while in the real-time mode but once the acquisition is stopped, automatic measurements can be performed.

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Automatic acquisition mode

The simplest way to quickly use the MTS^e to detect any faults on your fiber optic link is to make use of the automatic acquisition function that is provided. This function allows you to automatically configure the MTS^e to use the optimum acquisition parameters (pulsewidth and range) for the link under test with respect to the selected time.

Once the acquisition has been made the automatic measurement mode displays all the detected events on the acquired trace. With the trace displayed you then use the powerful analysis functions to quickly identify any faults on the fiber.

Only two measurement configuration parameters need to be set : the laser wavelength (if a multi-wavelength module is used) and the required maximum acquisition time.

Note In automatic mode, all the parameters being reconfigured, overlay and marker functions are not possible when the acquisition is performed.

Setting up the automatic acquisition configuration

In the OTDR TEST SETUP window:

1. Select the Laser wavelength with the Acquisition:Laser option.
2. Select the Auto (Automatic) mode with the Acquisition:Mode option.
3. Select the acquisition period (5 seconds to 10 minutes) with the Acquisition:Acq. Time option.

Acquisition in auto-configuration mode

When you press the press the **START STOP** key, the MTS^e first executes an automatic configuration phase which is designed to allow the instrument to automatically configure the optimum parameters to be used for the acquisition.

To do this, the MTS^e executes a three phase automatic configuration process:

- Phase 1: Gives an indication of the quality of the connection (refer to "Connection quality indicator" on page 5-7).
- Phase 2: Chooses the best range to see all of the fiber under test.
- Phase 3: Chooses the pulsewidth required to accurately qualify the link i.e. gives the best resolution possible for a given dynamic range.

Note The pulsewidth depends on the maximum acquisition time selected.

- Phase 4 : averaging is realized. Averaged time and number of averages are displayed. At the end of the acquisition time, the automatic measurement is performed.

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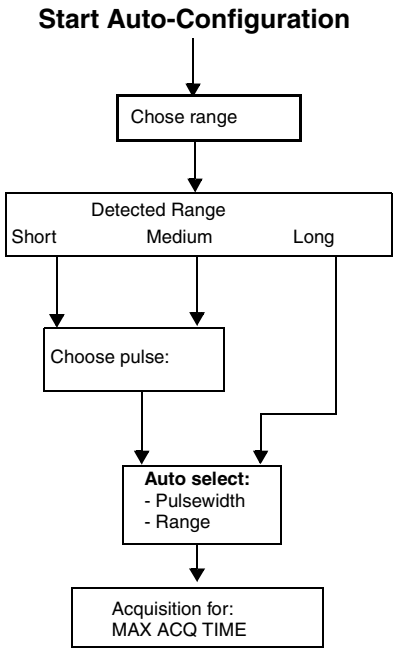

Auto-Configuration Process

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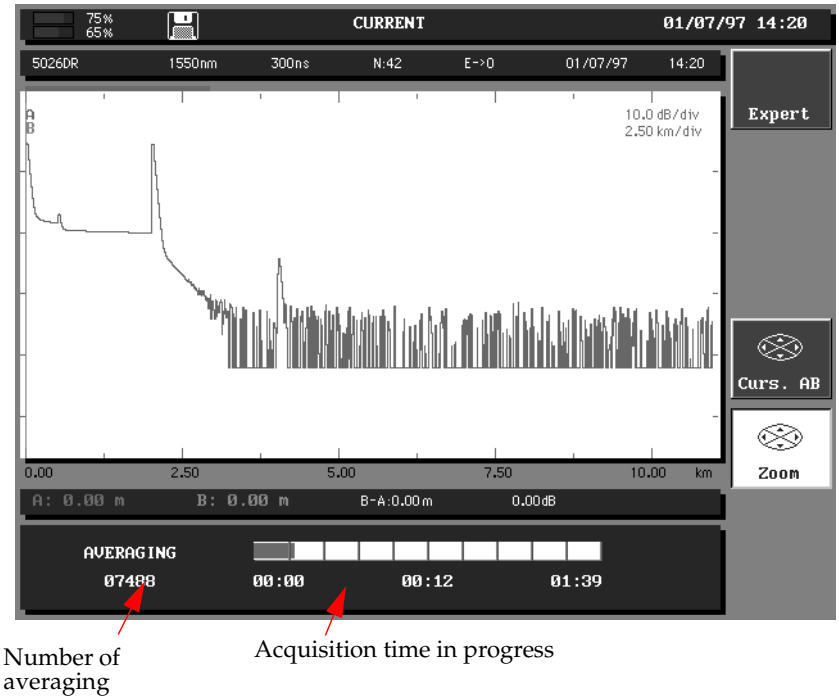

Acquisition measurement progress display

Note

You can push the **<START STOP>** key at any time to stop the acquisition measurement. If you do this, an automatic measurement is realized but certain events may not be detected because the instrument will not have made the required number of averages for an optimum measurement.

Once the auto-configuration phase has been completed, the parameters are automatically updated in the Acquisition menu.

Attention

The Auto-configuration mode invalidates the "lock markers" function (see "Locking markers" on page 5-27): the measurement is then re-initialized.

Manual acquisition mode

The manual acquisition mode makes a fixed number of averages depending on the maximum acquisition time specified in the menu Acq. Time parameter field and then stops the acquisition. The acquisition is performed using the previously selected Acquisition menu parameters. The acquisition can be stopped at any time with the **<START STOP>** key.

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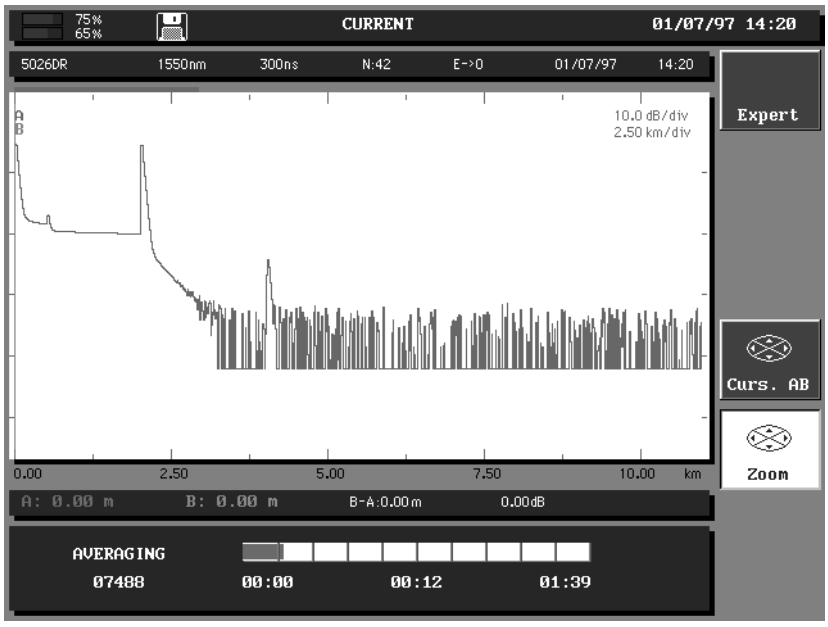
Use the following procedure to configure your manual acquisition in the OTDR TEST SETUP window (refer to "Selecting measurement acquisition parameters" on page 5-3):

1. Select the Laser wavelength with the Acquisition:Laser option.
2. Select the Manual mode with the Acquisition:Mode option.
3. Select the required pulsewidth with the Acquisition:Pulse option.
4. Select the Range you require, from the options available for the length of fiber you wish to test, Acquisition:Range option.
5. Select the Resolution value you require with the Acquisition:Resolution option.
6. Select the acquisition period (5 seconds to 10 minutes) with the Acquisition:Acq. Time option.
7. Press the **START STOP** key to start the acquisition.

   The red laser activity LED is on to indicate that the MTS^e is making an acquisition and the screen shows the acquisition of the trace as it is made. The quality of the connection is shown for a few seconds and an acquisition status indicator is also displayed on the screen to indicate the time remaining to complete the acquisition.



Acquisition in progress display

8. At the end of the acquisition the acquired trace is displayed on the screen, and an automatic measurement is performed.

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Note

You can push the **START STOP** key at any time to stop the acquisition measurement. If you do this, an automatic measurement is realized but certain events may not be detected because the instrument will not have made the required number of averages for an optimum measurement.

Case of the multi-wavelength acquisition

With a multi-wavelength module, to start the acquisition on each wavelength:

- In the Test Set-up menu, on the Laser line, select All.
- Start the manual ou automatic acquisition pressing the **START** button.

During the acquisition an icon in the upper bar shows that the acquisition is made on each wavelength.

The several traces are displayed in the same windows and can be used as in the overlay trace mode (see "Overlay trace function" on page 5-28).

Example of acquisition on two wavelength

Detection of traffic

If the fiber connected to the MTS^e for analysis is active, no measurement is possible. The MTS^e is fitted with a traffic detector which, in this case, displays a message indicating the presence of a signal in the fiber being tested. You must then:

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- Stop the measurement.
- Disconnect the source sending out the signals in the fiber or disconnect the network fiber.
- Restart the measurement.

Result analysis

Once you have completed an acquisition, Results are displayed to allow you to analyze the resulting trace.

Report on page 4-3 to see an example of OTDR Trace result display and its description.

The following functions are provided to make the analysis:

- Display functions: Cursor, Zoom and Shift of trace (horizontal and vertical)
- Analysis functions: Events, Addition of markers and Event Table
- Expert functions: Trace Overlay, Manual measurements, Free and Lock markers, Delete measurement results and perform an automatic measurement.

Using the cursors

The cursor function allows you to position the A and B cursors on the trace, to position or remove markers on the trace. Using the cursors in combination with the Slope, Splice and ORL functions lets you make individual measurements of any events on the acquired trace.

The cursors are represented as vertical axes:
- the selected cursor(s) is (are) a plain line
- the non-selected cursor is a dashed line.

Use the following procedures to use the cursor functions:

Cursors positioning/shift

When a trace is displayed on the screen, a key allows selection of the A or B cursor or the selection of both cursors. The selected cursors are shown with a plain line.

Use the < and > direction arrows to move the cursor (or the cursors) on the trace.

The window displays the following values below the trace:

- the distance of each cursor from the origin
- the distance between the two cursors
- the slope between the two cursors
- the attenuation between the two cursors

When one of the cursors goes off the screen, a horizontal shift is performed. Use the ↑ and ↓ keys to make a vertical shift.

If a cursor is off the screen when you select it, as soon as you start to move it, it will appear at the edge of the screen nearest to its last location.

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Zoom and shift functions

Zoom function

The Zoom function allows you to analyze a detected event in greater detail. Using the Zoom function in combination with the Event function allows you to quickly verify any uncertain events.

The zoom of the display is made around the selected cursor. If <Cursor AB> was selected the zoom is made at the mid point between the cursors.

The position of the displayed part of the trace with respect of the complete trace is located by a (grey or yellow) line on the top of the trace window. The cursors are represented by small vertical dot on it.

To gain access to the zoom function:

- Select a cursor and put it at the point of the trace to verify
- Press the <Shift> key in order to display Zoom
- Use the "<" and ">" keys to zoom in and out.

Note To reset the zoom and see the full trace, press and hold simultaneously the "<" and ">" keys.

Successive zooms on each event

- Zoom in on one of the event.
- Press the <Event> key.
- Use the "<" and ">" keys to move successively the display window on each event.

Shift function

The Shift function allows you to shift the trace on the screen using the arrow keys.

The Shift is centered on the intersection between the selected cursor and the trace. This allows to scroll horizontally the trace on the screen, following vertically the trace, thus maintaining the trace in the screen.

To gain access to the shift function:

- Select eventually a zoom level.
- Press the <Zoom> key in order to display Shift.
- Use the arrow keys to shift the trace in the chosen direction.

Events

Event display criteria

The Event function of the MTS^e is an invaluable tool for quickly positioning the cursor on detected events that have been measured and have their results displayed on the screen.

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Once you have made an acquisition and have results, you can simply press the **Event** key to move the cursor from event to event. Using this function in combination with the **ZOOM** and **CURSOR** keys allows you to rapidly analyze the fiber. When moving from one event to another, the zoom value is retained (except if this is not possible).

Notes

In order to display all the events, verify that the thresholds are set to ALL in the TEST SET UP menu.
In order to display the results on the trace, verify that the Results on trace option is activated in the TEST SET UP menu.

The display of an event depends on the selected attenuation and reflectance thresholds. It will be displayed if either of these values is above a threshold given in the TEST SET UP menu (refer to "Selecting measurement acquisition parameters" on page 5-3). Both results for an event will be displayed if both can be calculated. The following table lists examples of faults displayed for various attenuation and reflectance thresholds.

Ex.	Thresholds set		MTS^e will display a value if the attenuation or the reflectance has the following values	
	Attn.	Refl.	Attenuation	Reflectance
1	0.05 dB	- 60 dB	> 0.05 dB	› - 60 dB[a]
2	1 dB	- 15 dB	> 1 dB	≥ - 15 dB[b]
3	6 dB	---	> 6 dB	

a. example: a - 43 dB value will be displayed.

b. example: a - 14 dB value will be displayed but a - 20 dB value would not be displayed.

The event reflectance is always measured unless all the elements of the event cannot be measured, e.g. Peak saturation or an event lost in noise. In such cases instead of giving the exact calculated reflectance value e.g. -30 dB, MTS^e displays > - 30 dB to indicate that the reflectance is worse than -30 dB.

The display of a slope depends on the selected slope thresholds. It will be displayed if the value is above a given threshold in the TEST SET UP menu (refer to "Selecting measurement result display parameters" on page 5-4).

The following is an example of only hunting for all splice events that produce a loss of greater than 0.05 dB.

- Select the different thresholds of the events to be detected by pressing the **SET UP** key.
- Use the **RESULTS** key followed by the **<**Event**>** key to quickly move to each event that results in an attenuation greater than 0.05 dB.

Two point relative measurements can be made using the **<Event>** key in conjunction with the two cursors. This enables you for example to analyze the loss budget of a link which has a launch cable.

1. Position one of the cursors at the end of the launch cable.
2. Select the other cursor.

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3. Use the <Event> key. The measurements given are the true distance from the beginning of the link, and the attenuation of the link plus the attenuation of the connection.

This function may also be used to determine the loss budget for a partial section of the fiber under test.

The <Event> key is directly linked to the Table of Results which is described below.

Table of results

Two types of tables of results are available with the MTS^e:

- A single line table below the full trace display giving the type and characteristics of the event nearest the current cursor on the trace.
- A eight line table listing the events around the current cursor. The event line nearest the cursor is highlighted. The highlighted line is updated if you move the cursor or select the next/previous event.

Notes

In order to display all the events, verify that the thresholds are set to ALL in the TEST SET UP menu.

In order to display the results on the trace, verify that the Results on trace option is activated in the TEST SET UP menu.

To see this table, in the Results window, press the <Table> key. To scroll the table if it has more than 7 lines, either move the cursor, or press the <Event> key then the ↑ or ↓ keys.

Note

Each event is identified on the trace by an order number.

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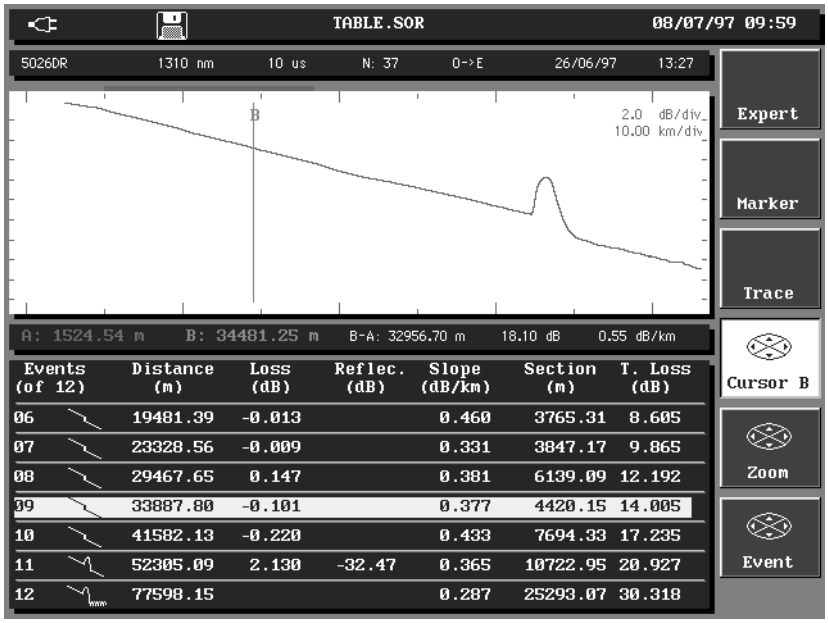

Table of results

To return to the display of only one line of the table, press the <Trace> key.

Information given for each type of event detected

- the type of event with its associated event number:

Non-reflective event (e.g. a splice).

Reflective event (e.g. a connection).

Reflective ghost.

Slope of the fiber (when no fault follows the slope).

End of the fiber.

ORL measurement

Global ORL measurement

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Event marker when a measurement cannot be made. If an added event is too close of an existing event, this icon appears on the trace and on the table for the second event, but no measurement is made : a manual measurement is necessary to have results for this event.

End of launch cable: losses and distances are referenced from this marker.

- The distance from the beginning of the fiber to the event, given in meters (kfeet or miles).
- The attenuation loss of the event causes, given in dB.
- The event reflectance, if any, in dB (or ORL if an ORL measurement has been performed).
- The slope value before the event.
- The section length, between the event marker and the previous marker.
- The total loss budget of the trace given in dB.

The Event Result Table is totally interactive and reflects the actual measurements that you make. Whenever you carry out an operation on the acquired trace the Event Result Table is immediately updated to show the result of the operation you made.

When a reflective event is saturated, the maximum value is displayed with a > sign. This indicates that the real reflectance is greater than the given value (e.g. >-29.5 dB means that the reflectance could be -18 dB).

When the Results on trace is activated in the TEST SET UP menu, the loss, reflectance and slope measurements are shown on the trace.

The reflectance of a ghost event is displayed in brackets on the trace.

Notes in table

To each event:

- a note (40 characters max) can be associated.
- an uncertainty indicator concerning the displayed result

They are displayed in the table, below the event line, if they are validated in the "Test Setup" menu of the "Result", in the Remarks in Table option.

Notes

For each wavelength, a maximum of 16 notes are possible.

For each note 40 characters can be entered. When uncertainties are validated, only the first 17 characters will be displayed or printed.

Note

Each note is associated to an event. So, if this event is erased, the note will be erased too.

To enter a note:

- in the table, choose the event
- press the <Expert> key

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- press the <Notes table> key and select the Notes option
- enter the note in the Edit menu.
- press the <Exit > key.

The user can display indicators in the result table to evaluate the uncertainty about the result. This function must be validated from the Test Setup menu, in the Result window with the Remarks in table option.

Indication of the level of confidence in result table

The following remarks are possible:

Indication of the level of confidence in result table	
Concerning loss measurements	
2c manual	Result of a manual measurement between the reference and the cursor, “two cursor” method.
5c manual	Result of a manual measurement according to the “five cursor” method.
Global	The loss displayed is the global result for Fresnels that are not sufficiently separated.
Close evts	Several events being too close, only the attenuation of the last is displayed.
Concerning slope measurements	
Few points	Slope measurement using the linear regression method not using many acquisition points.
2 points	Slope measurement using the “two point” method.

Automatic detection and measurement

The automatic measurement performed at the end of the acquisition allows you to quickly detect all the events on the trace. All the detected events are then measured and displayed with automatic event markers. Then only the measurement results, or a table of results, are displayed for any of the events that are above the thresholds set in the *OTDR TEST SET UP* menu. The results are also displayed on the trace if the Results on trace option of the *OTDR TEST SET UP* menu is selected.

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Note If only automatic measurements are to be made, verify that the lock marker function is not activated (i.e. icon not shown in the title bar of the display).

Using this method of detection and measurement allows you to rapidly find all the events on the fiber under test.

If an automatic measurement does not detect all the events, additional manual measurements can be made.

To delete all the markers, select <Expert> followed by <Delete Results>.

When no measurements have been made, if you want to make an automatic measurement, select <Expert> followed by <Auto measure>.

The following measurement sequence is recommended:

1. Full automatic measurement. The instrument automatically locates and measures the events.
2. Addition of markers (in the case of low loss splices and close events). In this case, the MTS^e automatically measures the slopes before and after the selected markers and measures the splice losses.
3. Addition of manual measurements if necessary (in the case of very close events). The MTS^e follows the user measurements. All previous measurements are retained.

Note If you only want to perform automatic measurements when a measurement is already in place:
1. Press the <Expert> key.
2. Press the <Delete results> key.
3. Press the <Auto Measure> key.

Addition of markers

When performing measurements, it is recommended to use the following configuration:

- set thresholds to All in the TEST SET UP menu.
- set Results on trace to YES in the TEST SET UP menu.

You can manually position event markers anywhere on the trace where you want to make specific measurements using the automatic measurement mode with markers.

You can also specify locations where you want to position additional markers to those automatically placed during an automatic measurement. You can then use the automatic measurement mode with markers to display the results of all measurements made using the combination of these markers.

Display of markers

Markers are represented by :

- if they are placed by automatic measurements or with the <Marker> key.
- if they are placed by manual measurements in Expert mode.

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Adding markers

To add event markers:

1. Select a cursor.
2. Use the positioning arrows to move the cursor to the position where you want to add a marker.
3. Press the <Marker> key.
4. An event marker is displayed at the cursor location and a full measurement is immediately performed. The slope before the marker will start just after the previous marker (or the front end dead zone), and the slope after the marker will end just before the next marker or the end of fiber.

Warning about markers

Note
Do not add markers (with the marker key) after manual measurements, because this will convert automatically all the manual measurements.

Note
If two markers are too close, they appear on the trace and on the table but no measurement is made for the second marker. In this case a manual measurement is necessary to have results for both markers.

Note
There are two sets of markers: one for 1550 nm, the other for 1310 nm. Markers defined for 1550 nm will not be used at 1310 nm and vice versa.

Important
If the **<**Marker**>** key is pressed when the cursor is very close to an existing marker, this marker will be deleted.

Deleting markers

To delete a marker, position the cursor on the marker and press the **<**Marker**>** key. The selected marker is deleted and a full measurement without the marker is immediately performed.

To delete several successive markers, use the **<**Event**>** key to go to the first marker and press the **<**Marker**>** key as many times as necessary to delete the markers. The cursor will be positioned automatically on successive markers.

Deleting markers may lead to incorrect measurements.

Addition of manual measurements

Once you have made an acquisition with or without an automatic measurement you can add manual measurements of any events on the trace using the cursors in conjunction with the splice, slope and ORL functions. Whenever manual measurements are made, it is recommended to set to ALL the result thresholds, and to activate the Results on trace option in the OTDR Test Setup window.

The manual measurements are controlled with the <Manual> key accessible from the Results page, after pressing the <Expert> key.

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Making Slope measurements

To make a manual slope measurement:

- Press the **RESULTS** button to call the trace.
- Position the A cursor at the start of the section of the trace where you wish to measure the slope.
- Position the B cursor at the end of the section.
- Successively press the <Expert>, then <Manual>, then <Slope> keys.

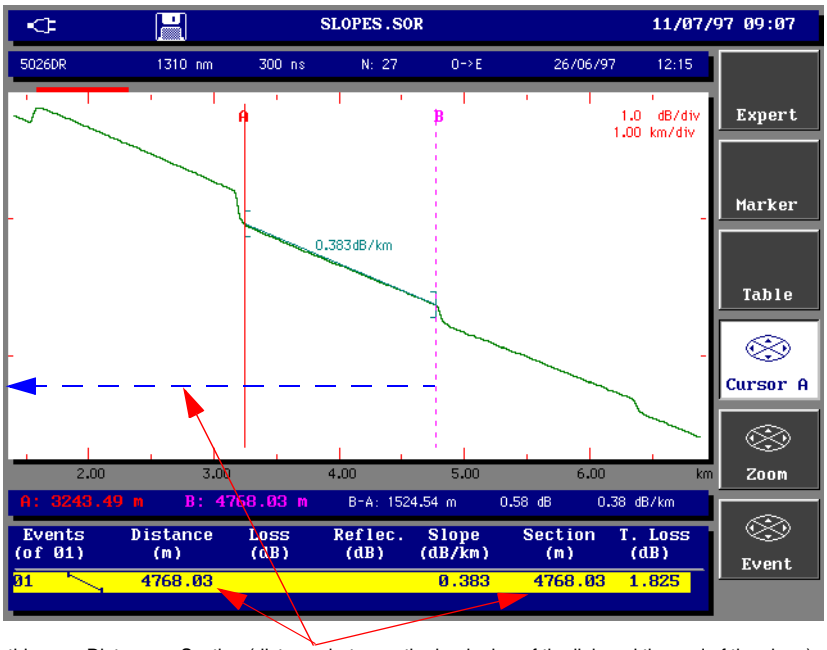
  The specified fiber section's slope is measured.

Slope measurement results

The result is displayed on the screen between the slope identifiers [ ].

The measurement results are also available in the event result table and can be displayed by pressing the <Table> key, if it is not already displayed (after pressing the <Exit> key to leave the Expert functions) :

- under distance is given the distance between the beginning of the trace and the end of the slope;
- under section is given the distance between the previous marker (if no marker : between the beginning of the link) and the end of the slope. This section is not the distance between the two slope identifiers [ ].



In this case Distance = Section (distance between the beginning of the link and the end of the slope)

Slope measurement

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If no result is displayed

If no result is displayed this can be due to:

- the display slope measurement result threshold is higher than the slope you are trying to measure,
- the Slope Threshold option in the OTDR Test Setup menu, is set to NO slope display.
- the distance between A and B is too short.

To delete a slope measurement

To delete an individual slope measurement result, superpose the A and B cursors on the concerned slope and press the **<**Slope**>** key.

Making splice and reflectance measurements

There are two methods of making manual splice measurements on the trace: the two cursor method and the five cursor method.

The five cursor method is the most accurate, because it takes into account the difference in level between the slope before the splice and the slope after the splice. It is recommended to always use this method if possible.

If a slope measurement cannot be made, due to very close events where the dead zone does not permit a slope measurement, the two cursor method should be used. The two cursor method takes into account the difference in levels between the cursors.

Before making either type of measurement, set the display splice and slope measurement result thresholds you require with the Splice Threshold and Slope Threshold options (*All* is recommended) in the OTDR Test Setup window. You should also enable the Results on trace option.

Two cursor method

To make a two cursor splice measurement, press the <Result> key:

1. Position cursor A exactly at the position of the fault and the cursor B after the splice you want to define. Select the A/B cursor.
2. Successively press the <Expert>, then <Manual>, then <Splice> keys.

   The splice event marker is positioned at the point defined by the first (left) cursor and the result is displayed on the screen. If the event is reflective, the reflectance value is also measured and displayed. These results are also shown in the event result table.

Important To perform a two cursor splice measurement always use the cursor A/B.

If no result is displayed this is due to: the display splice measurement result threshold being higher than the splice you are trying to measure, the threshold is set to *NO* splice display, or the Results on trace function being disabled.

Important If you try to measure a splice on a slope, the measurement is not carried out and the “slope found in region between two cursors” error message is displayed.

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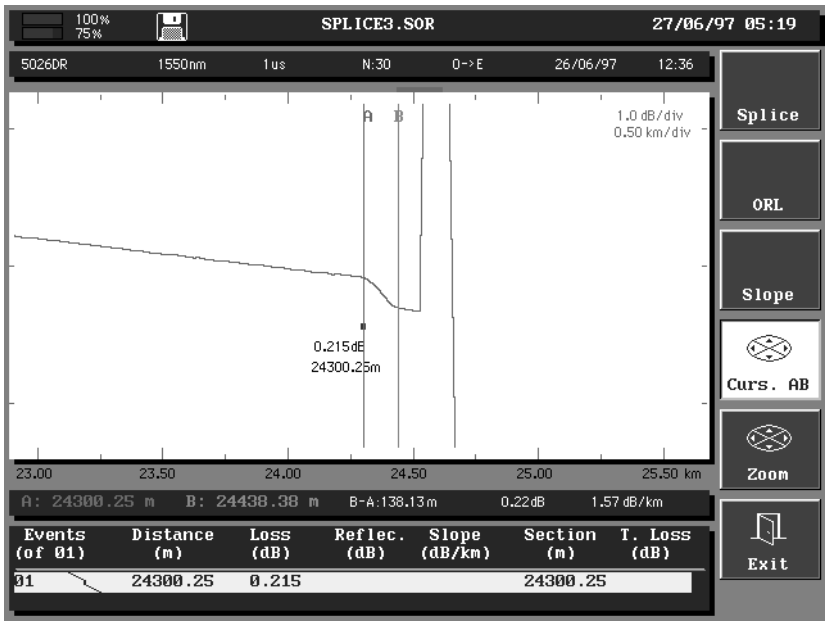

Two cursor splice measurement result

Five cursor method

To make a five cursor splice measurement:

1. Measure the slopes that precede and follow the fault to be measured using the slope function.
2. Position the cursor at a point between the two slopes (at the location of the fault).

Attention

Select cursor A or B, do not select the cursor A/B or a 2 cursor splice measurement will be performed.

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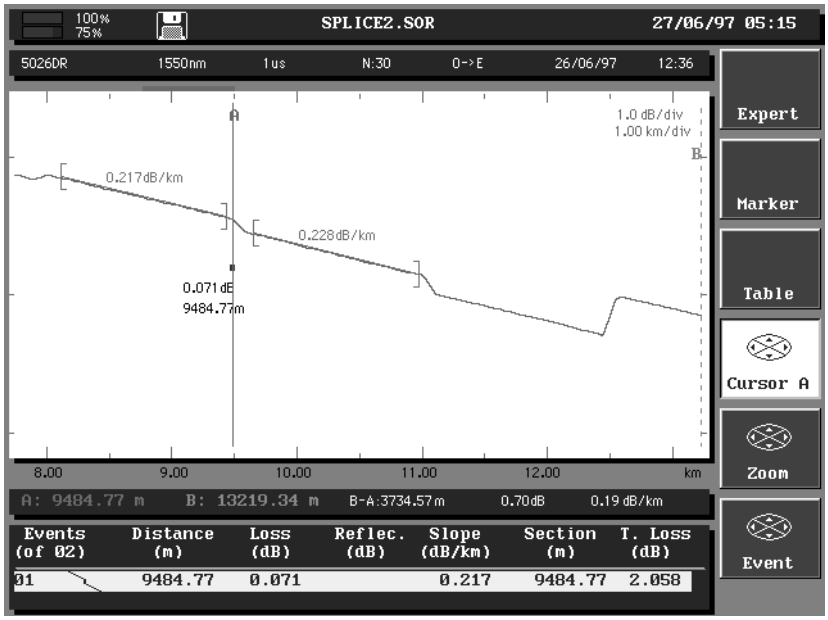

Five cursor splice measurement result

3. Successively press the <Expert>, then <Manual>, then <Splice> keys.

   The splice event marker is positioned at the point defined by the cursor and the result is displayed on the trace and in the event result table.

Important — To perform a five cursor splice measurement, when the <Splice> key is pressed, either the A or B cursor must be selected, NOT the cursor A/B.

Note — If no result is displayed this is due to: the display splice measurement result threshold being higher than the splice you are trying to measure, the threshold is set to *NO* splice display, or the Results on trace function being disabled.

Note — If you try to measure a splice on a slope, the measurement is not carried out and the "slope found in region between two cursors" error message is displayed.

Manual ORL measurement

The ORL can be measured for a section of the fiber.

Use the following procedure to measure a section of the trace:

1. Position the A and B cursors to define the section you want to measure.
2. Successively press the <Expert>, then <Manual>, then <ORL> keys.

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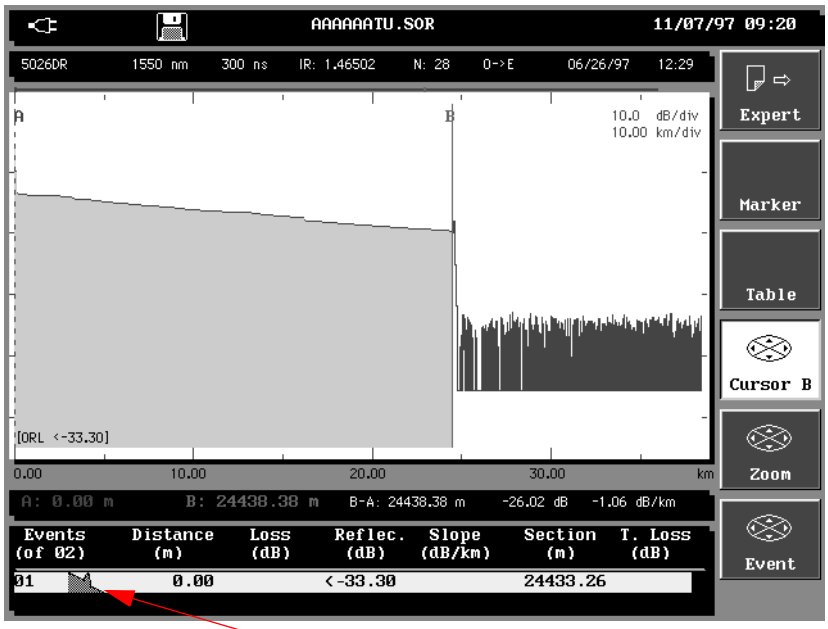
The ORL is measured for the section of the trace defined and the result indicator shows the ORL in dB in the table of results and on the trace.



ORL measurement result

ORL on a saturated trace

When events are saturated, then the ORL value is given with a < sign. This means that the real ORL is less than the value displayed.

Locking markers

To lock the markers in order to repeat exactly the same measurement on a future acquisition or another trace, press the **<**Expert**>** key then the **<**Lock markers> key. The lock marker icon is displayed in the display title bar.

The locked markers will then be used to realize the next measurements either at the end of the acquisition or when recalling a trace.

Note

This function locks markers placed by the automatic measurements, the <Marker> key and measurement markers added manually (<Manual> key).

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Recommended sequence

The following sequence is recommended:

1. Make an automatic measurement
2. add markers using the <Marker> key.
3. add required manual measurements (<Expert> / <Manual> key)

Attention

If a marker is added using the <Marker> key, after performing manual measurements, then all markers on the trace (. AUTO and MANUAL) will be converted to AUTO markers and an automatic measurement will be made using these manual markers. Previous slope results will be lost, 2 point measurements will be recalculated.

Whenever the lock markers icon is displayed, the automatic measurement following an acquisition is executed using the markers that were present before the acquisition.

If you only want to make a measurement without markers, press the <Free Markers> key to deselect the lock markers option.

Overlay trace function

The Overlay Trace allows you to have up to 4 traces on the screen at the same time. This function is very useful :

- for comparing traces acquired from several fibers in the same cable,
- for comparing traces from the same fiber over a period of time or at different wavelengths.
- for comparing traces resulting of measurements made in both directions of the fiber (see "Both End Measurement" on page 5-32)

In order to do this, the instrument is equipped with an overlay memory where the trace files to be overlaid can be stored. These traces can be:

- the current trace, for comparison with traces of new acquisitions.
- traces stored on a floppy disk or internal memory, for comparison with the current trace.

Overlay conditions

When traces have been set in the overlay memory, if an acquisition is made with acquisition parameters compatible with the overlay trace (pulsewidth and range), the acquired trace will remain on the screen to allow the comparison with the stored traces.

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Example : overlay of 3 traces

Transferring stored traces to the overlay memory

To display up to 4 traces originating from the memory, with the erasing of the current trace or the traces already loaded, do as follows:

- Find the file as described in the section "Finding files" on page 8-18.
- Press the <Load> key.
- Press the <Main+Overlays> key : as the traces are loaded, they progressively disappear from the file list.
- At the end of the loading, the Results screen is displayed: the first trace selected is the active trace (green on a colored screen), the other traces being overlaid.

Display of overlaid traces

- Traces are of different colors (the active trace is green).
- The name of the displayed traces is on the top of the screen, the same color as the trace (the active trace name is in square brackets).
- The markers are located:

  - on the active trace by the usual symbol ,
  - on the other traces by vertical dash.

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Adding overlay traces

With one or more traces already displayed, you can add other traces to the display (up to 4 traces on the screen at the same time can be displayed). To do this:

- Press the **FILE** key, and then in the Memory menu select the trace files to be added (see "Selection of several files" on page 8-18).
- Press the <Load> key.
- Press the <Add Overlay> key: as the traces are loaded, they progressively disappear from the file list.
- At the end of the loading, the Results screen is displayed: the new traces are displayed superimposed with the already existant traces.

If the number of selected files is above the allowed total of traces to be displayed, then a message indicating that only a partial load will be carried out: only the first selected traces of the authorised total of 4 will be displayed.

Overlaying the current trace

To copy the current trace in overlay memory use the following procedure:

- With the current trace displayed on the screen, press the <Expert> then <Overlay> key, then on <New>.

  The current trace is stored in the overlay memory: it is shown dimmed (or, with a color screen, in a different color) and it is automatically shifted above the new trace.
- It is possible to start a new acquisition.

Overlaying the current trace

Press the <New> key to copy the current trace in the overlay memory.

In the case of Multi-trace display with a multi-wavelength acquisition, pressing the <New> key removes all the displayed traces leaving an available space for new acquisitions.

Swapping overlay traces

Measurements can only be made on the trace that is active and not on overlay traces. To make a measurement on an overlay trace you must swap it with the active trace. To do so, press the <Swap> key.

Removing traces

To remove a displayed trace, you must first make it active (see previous section), then press the <Remove> key.

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Shifting traces

Manual shift of the current trace

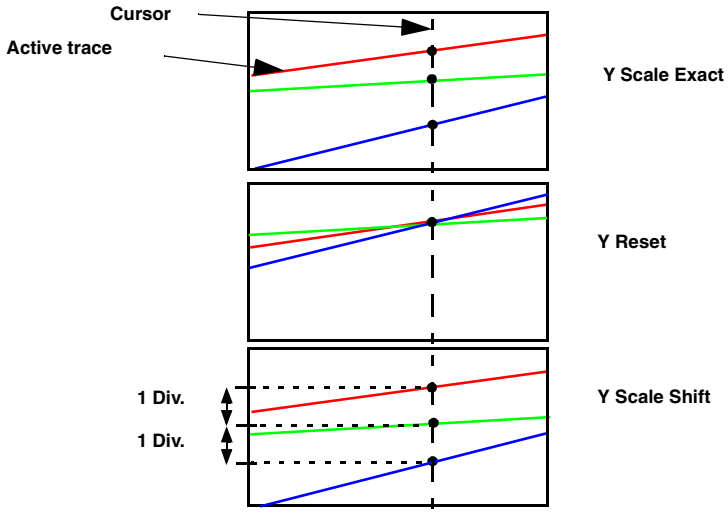
To vertically shift the active trace while the overlaid traces remain at their original position, select the Cursor mode, then use the ↑ or ↓ arrow key.

Manual shift of all the traces

To simultaneously shift the displayed traces, select the Shift mode, then use the ↑ and ↓ arrow keys.

Automatic shift of the traces

This vertical shift is made according to the active cursor location on the current trace. A key in the Expert/Overlay menu, allows the following choice:



Y reset	Focus the display on the active trace and adjust the overlaid traces at the cursor-current trace intersection point.
Y Scale Shift	Impose a vertical shift of one division between the traces at the level of the cursor
Y Scale Exact	Remove any Y shifts: the traces are at their exact position.

Exiting the overlay menu

To exit the overlay menu, press the <Exit> key.

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Both End Measurement

The Both End measurement function allows the results of measurements made in both directions of the fiber (Origin to End or End to Origin) to be used to obtain more accurate splice and connector loss results.

Measurement Principles

The Both End measurement function uses the Trace Overlay function "Overlay trace function" on page 5-28.

The traces obtained form the two measurements (one in each direction) are displayed with event markers. They are first displayed superimposed, then one of them is inverted (left ↔ right), in order that the markers associated to the same events are on the same horizontal position (see "Both End Measurement display" on page 5-34).

The Both End measurement result table show the following loss types:

- The O -> E and E -> O* losses correspond to the measurements made in each direction. They are different because the insertion loss and reflectance thresholds of the segments situated at either side of the event are different.
- The last loss is equal to half the sum of the two previous losses. By thus taking the average value of both previous results we eliminate the error due to the difference of the reflectance thresholds from either side of the event. Therefore this loss corresponds to the real value of the insertion loss of the event.
- The loss displayed in the last line of the table represents the total loss of the analysed link.

It is possible to define a splice loss threshold beyond which the result is displayed in red in the table. This threshold can be selected in the OTDR TEST SET menu, on the Splice Alarm Th. line, (see "Selecting measurement result display parameters for both end measurement" on page 5-5).

Execution of a Both End measurement

Display of two traces O to E and E to O saved in memory

In this case, before loading these traces, you have to check that:

- the two traces have not the same direction (E->O and O->E); if necessary change the direction in the Memory Info menu, on the line Direction from the **FILE** page.
- measurement results are available for both traces.

To load the traces, from the **FILE** page:

1. Select the required file and display it by successively pressing the <Load> and <Trace> keys.
2. Select the other file required and successively press the <Load> and <Overlay> keys to superimpose it over the previously displayed trace.

*. O=origin, E=End

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Acquisition of the two traces

If you need to make an acquisition in both directions:

- Make a measurement in one direction. The corresponding trace is displayed in the Results page.
- Successively press the <Expert>, <Overlay> and <2 Traces> keys to put this trace into the overlay mode.
- Make the second measurement in the other direction. The corresponding trace is displayed as the active trace.

Note The active trace (trace displayed as normal OTDR trace) serves as the distance reference.

Note To swap the traces so the trace in overlay mode becomes the active trace, press the <Expert>, <Overlay> and <Swap> keys.

Accessing the Both End measurement mode

Successively press the <Expert>, <Overlay> and <Both End Overlay> keys. The overlayed trace is inverted.

Attention The <Both End Overlay> key is only present if two compatible traces are displayed.It is not available if the traces are not compatible or if there are more than two traces.

The two traces are aligned on the x axis, by taking into account the launch cables declared "Launch Cables" on page 5-35. The markers corresponding to the same event, on each trace, are therefore superimposed on the X-axis. A small gap can separate these two markers linked to the same event (e.g. gap due to a slightly different length of the fiber according to the measurement direction). You must select in the OTDR TEST SET menu, on the line Dist. Spacing Th., the threshold beyond which the markers will be considered as linked to different events.

Description of the active and non-active traces

- The active trace is represented in green (dark grey with a monochrome screen), the other trace is in blue (light grey with a monochrome screen).
- The characteristics of the active trace are displayed in a status bar above the trace.
- The active trace is represented with its markers and measurement results.
- On the non-active trace the markers are represented with a vertical dash.

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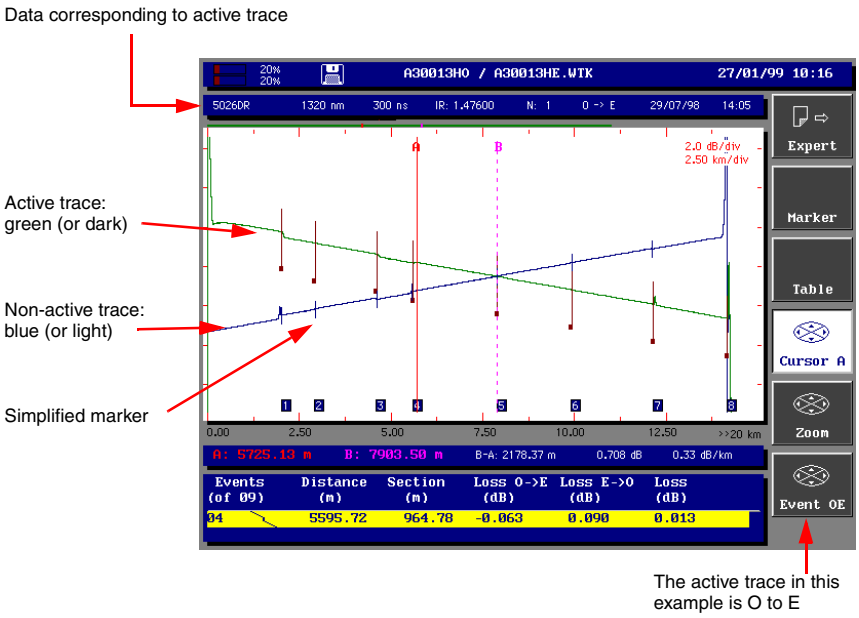

Both End Measurement display

Changing the active trace

If you are in Cursor or Zoom/Shift mode, press the <Evt OE> key. The event search function is activated and can be started with the directional keys.

Pressing the <Evt OE> key again causes the active trace to become non-active and the non-active trace to become active. The markers and results are then displayed on the new active trace.

Changing the active trace keeps the active cursor at the same position, this allows a new marker to be easily positioned on the new active trace at a position marked by the cursor on the previously active trace.

Both End measurement method

To obtain the Both End measurement results in the result table, all the events must have been detected and measured in both directions. If the automatic measurement has not detected an event in one of the directions:

- On the corresponding trace there is no maker for this event.
- In the result table there is neither the corresponding loss value (E to O or O to E) nor the real calculated loss value.

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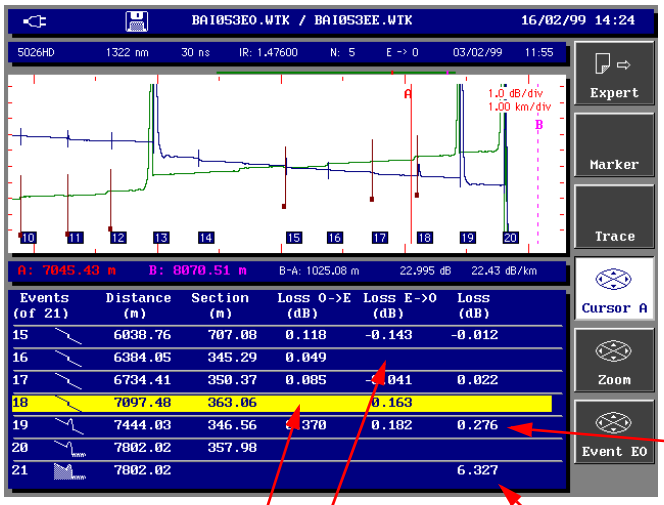
BA1053EO.WTK / BA1053EE.WTK
16/02/99 14:24
5026HD 1322 nm 30 ns IR: 1.47600 N: 5 E -> O 03/02/99 11:55
1.0 dB/div
1.00 km/div
Expert
Marker
Trace
Cursor A
Zoom
Event EO
A: 7045.43 m B: 8070.51 m B-A: 1025.08 m 22.995 dB 22.43 dB/km
Events (of 21) | Distance (m) | Section (m) | Loss O->E (dB) | Loss E->O (dB) | Loss (dB)
15 6038.76 707.08 0.118 -0.143 -0.012
16 6384.05 345.29 0.049
17 6734.41 350.37 0.085 0.022
18 7097.48 363.06 0.163
19 7444.03 346.56 0.182 0.276
20 7802.02 357.98
21 7802.02 6.327
Non detected event
Total result of the fiber link (distance and loss) without
Results displayed in red if they exceed the splice alarm threshold defined in the OTDR TEST SET menu.

Result Table

A marker must therefore be placed on the corresponding trace, at the position where the event was detected in the other direction. A measurement is then made automatically at this marker (see "Addition of markers" on page 5-21).

To do this, see "Changing the active trace" on page 5-34.

Carry out the same procedure for all the non detected events on each trace. The result table should then show all the results.

If one or more splices could not be measured in semi-automatic mode, for example if the segment of the fiber is too short to make linear regressions, then manual measurements must be made (see "Addition of manual measurements" on page 5-22).

Launch Cables

If the fiber uses a launch cable at one or both ends, it is possible to eliminate results linked to launch cables in identifying it or them in the menu **SET-UP** / Test Setup / Results on lines:
- Launch Cable O->E
- Launch Cable E->O.

In each case the identifiers “Marker 1” or “Marker 2” and “Marker 3” are available.

Example:

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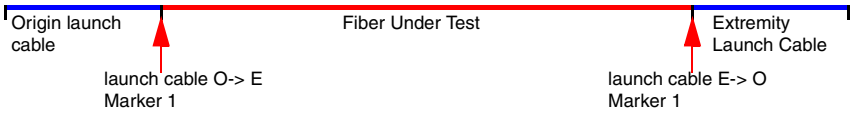

Saving Both End measurement result table

Once the result table is complete, it is possible to save it as an ASCII file which can be imported into EXCEL. This file has the extension .OEO.

First the two traces must be saved if they have been created or modified.

- Save the active trace, by pressing the <Store> key, after choosing the WTK or SOR format.
- Swap the active trace.
- Save the other trace, by pressing the <Store> key, after choosing the WTK or SOR format.
- Save the both end measurement result table by pressing the <Store both end> key.

Note The traces and the both end measurement result table must be saved in the same directory. Otherwise when recalling the table, the associated traces are not recalled.

Note If the traces have been modified and not saved the MTS^e will refuse to store the both end measurement result table.

Note This table contains the links to the two trace files, so when it is loaded, the traces are loaded too.

Opening the table with Excel

To open the table with Excel, select “Tabulation” as the field separator. To do this in the Excel Text Import Wizard click on the “Delimited” radio button then press the <Next> key. Check the “Tab” check box and press the <Finish> key.

For more details about this function, see "Transferring MTSe file (table) to Excel" on page 8-11.

Loading the both end measurement result table

If one of the two trace files, or both files, have been modified or deleted after saving the table, the MTS^e will import the table but will not import the traces which will be replaced by two straight horizontal lines. A warning will also be displayed on the screen during loading.

Note Loading a table is only possible if it has not been modified by a spread sheet program (Excel or other).

Exiting the both end measurement mode

Use either of the following two methods to exit the both end measurement mode:

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- Return to the normal display of the two traces in overlay by successively pressing the <Expert>, <Overlay>, <Standard overlay> keys.
- Return to displaying a single trace by successively pressing the <Expert>, <Overlay>, <1 trace> keys.

Note The MTS^e also exits this mode if a new trace is loaded or a new acquisition is started and the trace obtained is not compatible with the active trace.

Fault locator mode

Function

The Fault Locator detects the distance from the beginning (origin) of the fiber to the end, thus locating any possible break in the fiber.

Choice of function

Press the **SETUP** key, then the <Config. Instrument> key and select the Fault Locator icon "Instrument Set up" on page 3-11.

Configuring the test

Press the <Config. Test> key. Three parameters must be defined:

Acquisition Laser	wavelength of signal emitted (1310 or 1550 nm, 850 or 1300 nm, 1550/1625 nm depending on module).
Index	index of fiber. It is then possible either to choose this index directly by using the arrow keys < and >, or to choose the type of cable in the proposed list by pressing the <Preset Index> key. In this latter case, move the cursor to the type of cable by using the < and > keys, then press the key <Confirm Index> to validate this choice. See "Preset index values" on page 5-6.
Fiber end threshold	Loss threshold corresponding to the end of the fiber being detected: Auto or Manual (from 3 to15 dB). The Auto position is recommended.

Starting the test

Press the **START/STOP** key.

The test is configured automatically, then a bar graph indicates the state of progress of the test and the number of acquisitions made.

By default, the test lasts 1 minute, but it may be stopped at any moment by pressing the **START/STOP** key.

At the end of the test, the instrument measures the distance of the end of the fiber and displays the value in the chosen units.

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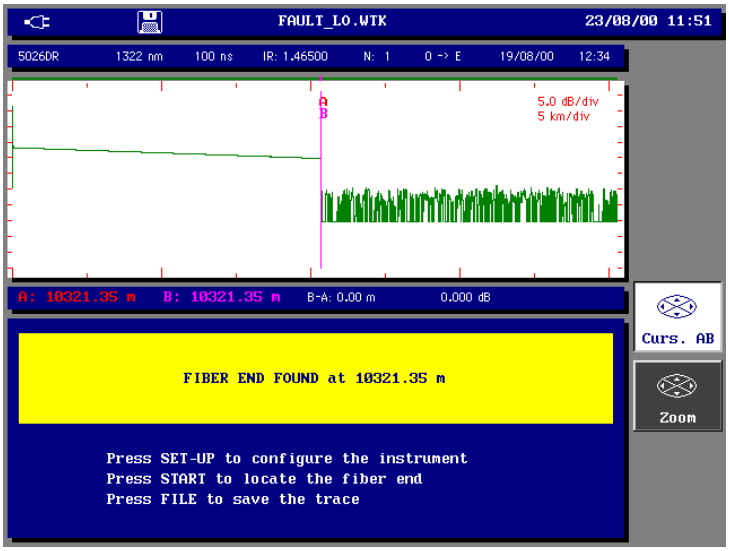

Fault location

The OTDR trace is also displayed with the cursors A and B placed on the end of the fiber. Cursor and Zoom keys are available.

Messages indicate how to return to the instrument configuration menu (**SETUP** key) and to locate the end of the fiber again (**START** key).

The trace may be saved as a normal trace (see chapter 8). After it has been recorded, it may be viewed:

- either in OTDR mode (with analysis) if the OTDR function is chosen in the Instrument configuration menu.
- or in Fault location mode (with indication of end of fiber), if the **FAULT LOCATOR** function is chosen in the Instrument configuration menu

Macro

The macro function gives the possibility of starting a sequence of actions (up to 200) by only a single key.

There are five macros :

- Three user macros (1 to 4)
- A predefined macro, macro 5 (DUAL LASER) which starts a bi-lambda measurement with storage of acquisition and comparison of traces.

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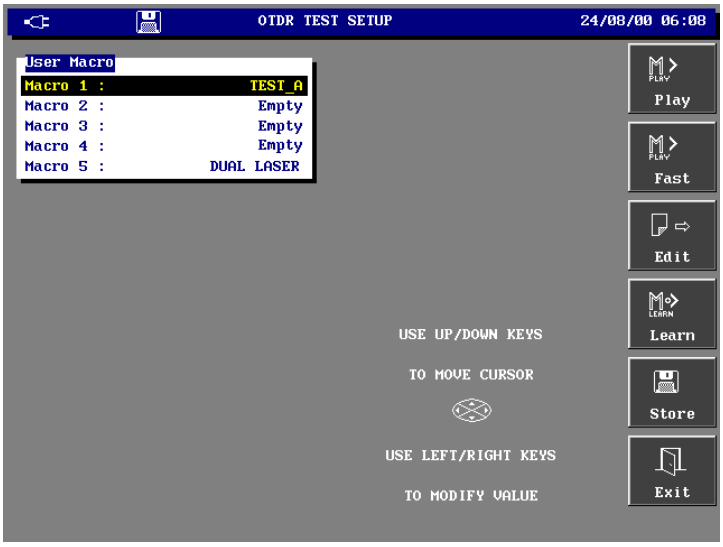

Macro menu

Starting a macro (Play)

- Press the **SET-UP**, then the <Macro> key.
  The Macro menu appears.
- Select the macro to use
- Press the <Play> key if you want to execute the actions with the same delay as when creating the Macro; press the <Fast> key to execute the successive actions of the Macro without any delay.

1. For the user macros (1 to 4), the configuration of the MTS^e is restored, like it was when the macro was created.
2. All the actions saved in the macro will be executed (the delay between actions has been saved).

Note Pressing one of the keys interrupts the macro.
At any time it is possible to quit the macro menu by pressing the <Exit> key

Note The configuration of the MTS^e is not modified when the predefined macro is played.

Attention After a software up-grade the macros previously created may not functions correctly if they use keys which have been modified.

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Creating a user macro 1 to 4 (Learn)

Precautions before creating a macro

- **Set-up the** MTS^e.
  When a macro is played, the MTS^e set-up is restored to the state when creating the macro. Therefore it is advised to set-up the MTS^e before creating the macro. The macro will then be executed faster and will occupy a smaller file.
- **Prepare the sequence of actions**.
  When creating a macro, delays between actions are saved too. When executing the macro, there delays will be respected if the Macro is started by <Play> and they will be ignored if it is started by <Fast>.

To create a user macro:

- Press the **SET-UP** key, then the <Macro> key (see "OTDR TEST SETUP window" on page 5-2).
  The macro menu appears.
- Select the macro 1 to 4 to define.
- Press the **<Edit>** key and give a name to the macro (see "Editing" on page 4-5).
- Press the **<Learn>** key.
  The preceding macro will be erased. Then you are requested to:
  - either confirm the creation of a new macro with the <Confirm> key.
  - or stop the operation with the <Abort> key.

Note If the operation is confirmed, the macro save the actual MTS^e configuration. This configuration will be recalled with the macro. See "Use of the macro to store a configuration" on page 5-41.

- After confirmation, enter the successive actions (set-up, acquisition, storage, etc.). 200 actions can be saved. The delay between each action is also saved.
- After the last action, go back to the set-up menu using the **SET-UP** key and press <Macro end>.

Note If the created macro does not work, increase the pause after the disk store or print steps.

Saving a macro on a floppy disk

Saving macro on floppy disk allows the user to copy macros from one MTS^e to other ones.

To save a macro on floppy disk:

- In the file menu, select the macro file name.
- In the macro menu (called by the SET-UP then <Macro> key), select the macro to save.
- Press the <Store> key.

  The macro is stored on the floppy disk with the extension.mac.

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Loading a macro from a floppy disk

- Press the **FILE** key.
- Press the <Explore> key and select the directory of the floppy disk.
- Press the <Open Dir> key and select the macro file. It has a .mac extension.
- Press the <Load Macro> keys. The keys <Macro 1>, <Macro 2> , <Macro 3>, <Macro 4> are displayed.
- Select one of these positions to transfer the macro.

Use of the macro to store a configuration

With the MTS^e set-up with the configuration you wish to save:

- Press the SET-UP, then the Macro key.
  The Macro menu is displayed.
- Select one of the three user macros and press the <Edit> key to eventually change the name.
- Press the <Store> key and confirm the action.
- Press the <Macro end> key.

  The MTS^e configuration is saved in the corresponding macro. Loading this macro will load the configuration.

Set-up parameters saved in the macro

- the instrument set-up (OTDR for example).
- the test set-up.
- the markers if they are locked (by the <Expert> /< Lock markers> function).
- in the file menu, the Auto-increment and the auto file naming.
- zoom/shift value, cursor positions, etc.

Note Instrument and test set-up can only be restored if the instrument is equipped with the corresponding module.

Macro 5 description

The macro 5 starts a measurement at each wavelength (1310 and 1550 nm or 850 and 1300 nm) and stores the results.

Parameters to set-up before starting the macro

1. Acquisition parameters
   - Manual mode
   - Pulsewidth
   - Range
   - Resolution
   - Acquisition time
2. Configuration parameters
   - OTDR Module: Dual-wavelength
   - File naming: Auto
   - File Nbr Increment: No

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- Markers: not locked
- Fiber Number

The macro 5 starts the following actions:

- acquisition for the selected time
- storage of acquisition and results (first wavelength)
- overlay
- wavelength change
- new acquisition for the selected time
- storage of acquisition and results (second wavelength)
- incrementation of the fiber number.
- return to the Macro menu.

Note The macro 5 can only be started with the <Fast> softkey.

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Chapter 6

Using the OTS module

This chapter describes the different steps required to make an OTS measurement:

- ❏ OTS Test Setup
- ❏ OTS Result Display
- ❏ OTS measurements
- ❏ Result acquisition methods

OTS Test SET-UP[1]

To set up the OTS and then make a measurement of the fiber under test the following parameters need to be configured:

- ❏ Light source parameters (if available): Wavelength, Transmission mode, Scanning, Power type and Unit required.
  All these parameters are configured from the Light Source menu of the OTS Test Setup window.[2]
- ❏ Power meter parameters (if available): Wavelength, Range, result storage mode and storage frequency, Real Time mode, Unit required, External Attenuation and Alarm Threshold.
  All these parameters are configured from the Power meter menu of the OTS Test Setup window.[2]

1. If an OTS module is installed
2. To call the OTS TEST SETUP window to select the required source and power meter parameters, press the <SET-UP> button. If either the SYSTEM or INSTRUMENT SETUP windows are already displayed press the <Test Setup> key to call the OTS TEST SETUP window.

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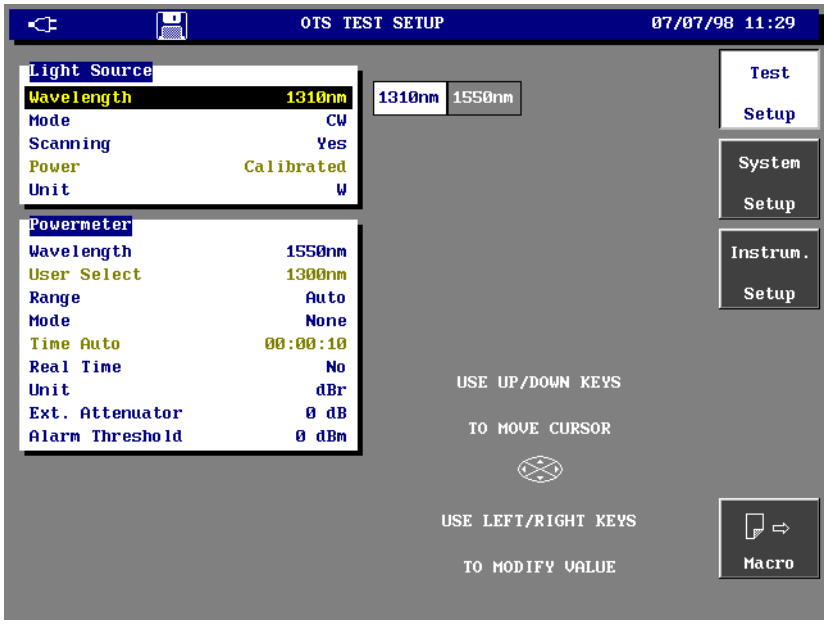

OTS TEST SETUP window (including light source and power meter)

In these windows, the selected parameter is high-lighted. Select this parameter using the ↓ and ↑ directional arrows.

The available choices are displayed on the screen; these depend on the chosen function. Make the required choice with the ← and → directional arrows.

Selecting Light source parameters

You can choose the following Light source parameters, from the Light Source menu of the OTS Test Setup window:

Wavelength	The required source: 1310 nm or 1550 nm for LASER source, 850 or 1300 nm for LED sources.
Mode	Choose the transmission mode: CW: Continuous signal. 270 Hz, 330 Hz, 1 KHz and 2 KHz: the source transmits a modulated signal at the frequency selected. Emul. OLS: to communicate with an Acterna OLS or OFI instrument.
Scanning	The source then switches every 10 seconds between the two wavelengths and provides a signal indicating the wavelength of the transmitted signal. When the Scanning

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mode is selected, the output power is calibrated (CAL).
In the "Emul. OLS» mode the signal is alternated every 4 s. in order to be compatible with the TwinTest mode of the OLS and OFI Acterna series.

Power — Mode only available with laser sources.
Choice of the output power of the laser source:
CAL: Output power calibrated at 1 mW i.e 0 dBm.
VAR: Variable power from 0 to - 10 dBm.

Note — The Power option is only available if the continuous signal (CW) mode has been selected and the Scanning mode is NOT selected. If this is not true the output power is calibrated by default.

Unit — Choice of the transmitted power unit: W or dBm.

Selecting Power meter parameters

You can choose the following Power meter parameters from the Power meter menu of the OTS Test Setup window[1]:

Wavelength — Selection from: Auto, 850nm, 1310nm, 1550nm or User. (Selecting the User wavelength allows you to select the exact wavelength you require with the User Select menu option described below).

User Select — Selection of the any wavelength value between 800 nm to 1650 nm in 1 nm steps, using the arrow key <- or ->.

Note — The User Select menu option is only available if User has been selected from the Wavelength menu option.

Range — The measurement range of the power meter: Auto, mW, µW or nW. If Auto is selected the optimal range is chosen for the Power meter acquisition.

Mode — Selection of the measurement result storage method: None, Autostore orAutoprint.
None: No measurement results are stored.
Autostore: The autostore mode automatically stores the measurement results to a file at the time interval selected with the Auto Time function described below. Refer to "Manipulating stored data" on page 8-16 for the description of the file storage function.
Autoprint: The autoprint mode automatically send measurement results to a printer connected to the

1. During storage and printing operations none of the menu options apart from the Unit and Alarm Threshold can be modified.

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	instrument at the time interval selected with the Auto Time function described below.
User Select	Selection of the any wavelength value between 800 nm to 1650 nm in 1 nm steps, using the arrow key <- or ->.
Time Auto	Choice of the time interval between measurements for Autostore or Autoprint. This interval can be a period (between 1 second and 11 hours 59 minutes and 59 seconds), in 1 second increments. It is selected by the Arrow key <- and ->.
Real Time	Choice of the real time or averaging mode. When this mode has not be selected the power meter is, by default, in averaging mode.
Unit	Selection of the measurement unit: W, dBm or dBr.
Ext. Attenuator	Entry of the value (0 to 30 db) of an external attenuator, if one is being used. It is selected by the Arrow key <- and ->.
Alarm Threshold	Selection of the required alarm threshold (-70 to +30 dBm).

OTS Results Window

The OTS Results window contains the Light source display and Power meter display. These are only displayed if they have been selected from the Instrument Setup window and if they are available.

Depending on the selection made they are either both shown together or only the single selected unit.

The <Source> and <Power meter> softkeys select either the Light source or the Power meter functions in the OTS results window.

A key also provides the results in memory to be displayed.

Note

When this memory is recalled with both the Power meter and Light source windows, the Light Source window is reduced to a single line at the bottom of the screen.

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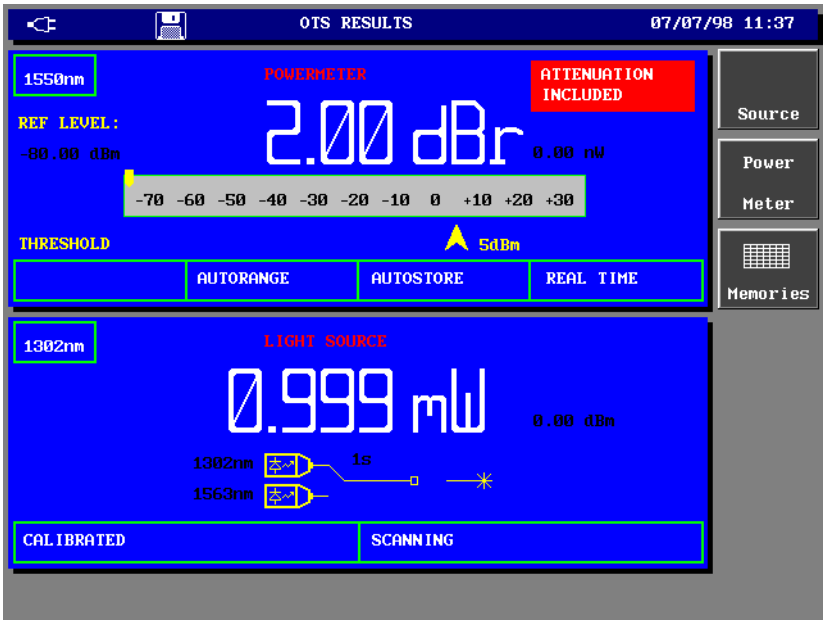
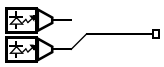


OTS Results Window (including light source and power meter)

Light Source

Light Source Display

The Light source display provides all the details of the currently selected Light source configuration. It also contains the specific softkeys required to control the various functions of the Light source when it is selected.

- The selected wavelength.
- The light power in the selected unit and the non-selected unit.
- The power mode: Laser (or LED) Off, Calibrated or Variable (for laser source only).
- The transmission mode: CW or the modulated frequency (270Hz, 330Hz, 1KHz, or 2KHz). The icon is displayed when the modulated frequency mode is selected.
- SCANNING and the icon  when the scanning mode is selected.
- the icon when the source is in operation.

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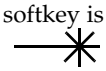
Light Source Softkeys

The following softkeys are available when the laser source function is selected from the OTS Results window:

<Laser On> / <Laser Off> (or <LED on> / <LED Off>)
used to switch the light on and off. When <Source> is selected from the OTS Results window the <Laser On> (or <LED on>) switches on the source and the other specific source softkeys are displayed. When the source is on the softkey is labelled <Laser Off> (or <LED off)> and the icon  is displayed next to the wavelength indicator.

Note None of the following softkeys are available unless the source is on.

<Toggle Laser> (or <Toggle LED>)
switches between the two wavelengths: 1310 and 1550 nm with laser source, 850/1300 nm with LED source.

Note None of the following softkeys are available unless the CW transmission mode is selected.

<Send Lambda> transmits a lambda signal to the Power meter to automatically switch the power meter to the wavelength of the source.

<Mode> this key allows the transmission mode to be chosen: CW or modulated frequency: 270Hz, 330Hz, 1KHz, or 2KHz.

With laser source, if the CW and variable power option has been selected, the arrows keys increases and decreases the laser output power. It is then displayed on the left side of the screen.

<Return> exits the source functions and returns the <Source> and <Power meter> selection softkeys.

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Laser Source Display (if available)

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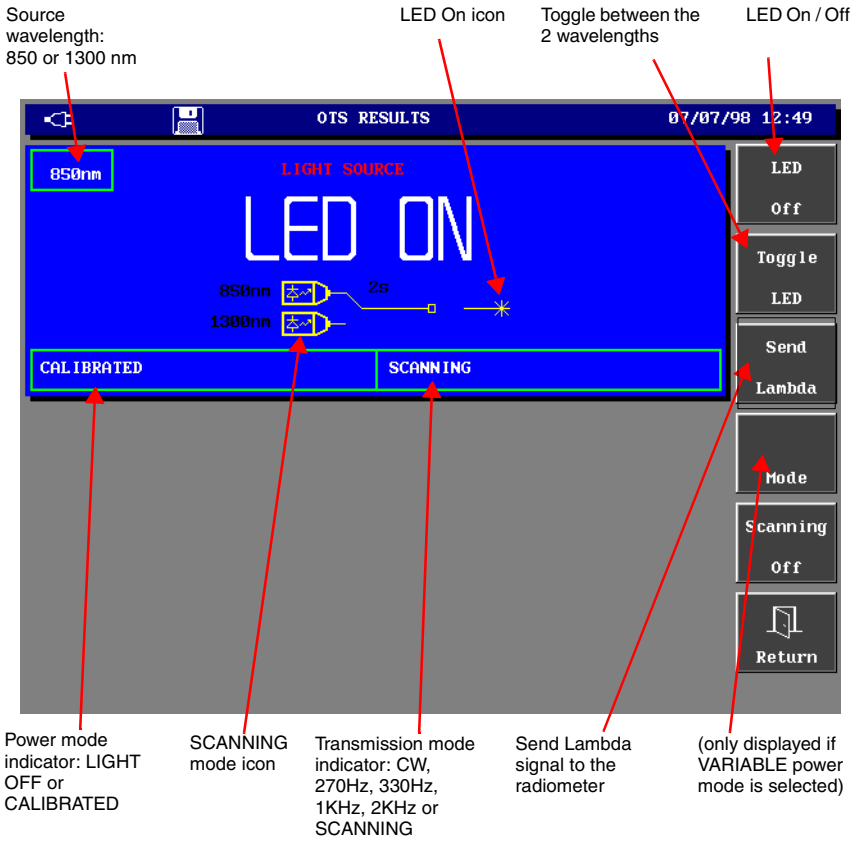

LED Source Display (if available)

Power meter

Power meter Display

The power meter display provides all the details of the currently selected power meter configuration. It also contains the specific softkeys required to control the various functions of the power meter when it is selected.

- The selected source wavelength: 850 nm, 1310 nm, 1550 nm (Calibrated values) or any user value between 800 nm and 1650 nm in 1 nm increments.
- The measured light power in the selected unit and the non-selected unit.
- The selected reference level value in dBm.
- The measured light power cursor showing the value in dB.

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- The selected threshold cursor showing the current threshold in dB. Pressing the ← and → directional arrows modifies this value.
- The icon that indicates an audible alarm will be given if the measured power passes the selected threshold.
- The AUTOLAMBDA indicator shows that the automatic selection of the same wavelength as the source when a send lambda signal is received.
- The AUTORANGE indicator shows that the optimal measurement range will be used to measure the received light power.
- The AUTOSTORE indicator shows that measurement results will be automatically saved when the **START/STOP** direct access key is pressed and the **RUN** indicator is on.
- The AUTOPRINT indicator shows that measurement results will be printed when the **START/STOP** direct access key is pressed and the **RUN** indicator is on.
- The REALTIME indicator shows that the real time mode is selected and the measured value displayed is being made in real time rather than as an averaged measurement.
- ATTENUATION INCLUDED if a value has been selected on the Ext. Attenuator line of the Test Setup menu (Radiometer).

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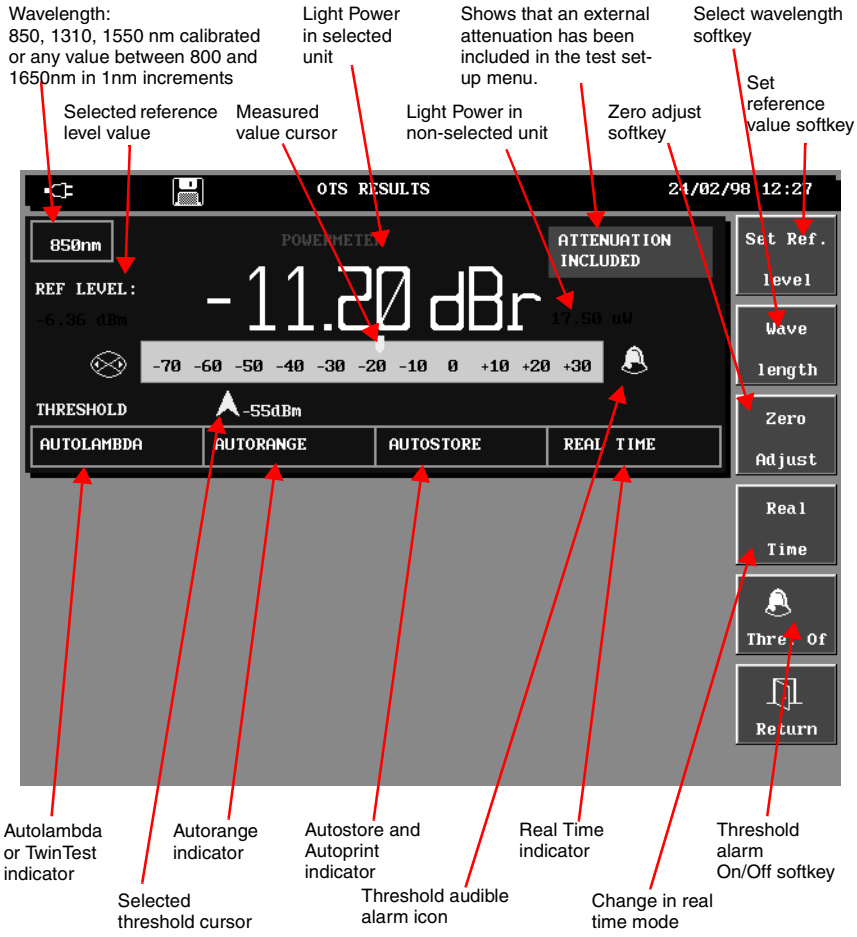

Power meter display

Power meter Softkeys

The following softkeys are available when the power meter function is selected from the OTS Results window. Certain selections can also be made from the Test Setup menu.

- The <Set Ref.> key[1] which is used to select the currently displayed value as a reference value to compare to other measured results. When the <set Ref.> key is pressed the currently displayed value is displayed below the REF

1. Not available during Autostore or Autoprint operations

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LEVEL legend on the power meter display and remains displayed until another value is selected.

- The <Wavelength> key[1] is used to select the required measurement wavelength. Each press of the key toggles the available calibrated wavelengths (850, 1310 1550nm), the currently entered User Select wavelength and Autolambda automatic wavelength selection.
- The <Zero Adjust> key[1] is used to adjust the zero setting of the power meter when a blanking cap is fitted to the power meter optical input.
- <Real Time>: selects displaying the results in real time (not averaged).
- The <Thre. On> / <Thre. Of> key toggles the audible threshold alarm on and off.
- The <Return> key exits the power meter functions and returns the <Source> and <Power meter> selection softkeys.

OTS Measurements

Use the following general procedure to make measurements with the OTS module:

- Zero the power meter
- Make a reference measurement with a jumper connected between the light source output and the power meter input.
- Replace the jumper with the fiber under test and measure the power. The power measured corresponds to the insertion loss of the fiber under test.

Adjusting the power meter zero setting

Use the following procedure to adjust the zero setting of the power meter:

1. Fit the blanking cap to the power meter input to ensure no light reached the photodiode of the power meter.
   Carrying out the zero adjustment without the blanking cap installed will cause a "Measurement Error" message to be displayed because the photodiode will have detected too much ambient light.
2. From the OTS Results window press the <Powermeter> softkey to access the power meter functions of the OTS.
3. Press the <Zero Adjust> softkey.
   The zero adjustment is made and <Zero Adjust> key is displayed white until it is finished.

Making a reference measurement

Use the following procedure to make a reference measurement:

1. Fit an adapter to power meter input in order to connect a jumper.
2. Connect a jumper between the output of the light source and the input of the power meter.
3. Configure the light source and power meter so that both are using the same wavelength.

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4. From the OTS Results window press the <Source> softkey to access the Light source functions of the OTS.
5. Press the <Laser On> (or <LED on>) softkey.
   The resulting measured power is displayed on the power meter.
6. From the OTS Results window press the <Return>, then <Power meter> softkey to access the power meter functions of the OTS.
7. Press the <Set Ref. Level> to store the displayed value as the reference level.
8. Press the <Return> then the <Source> softkeys.
9. Press the <Laser Off> (or <LED off>) softkey to switch off the source.

Measuring the fiber under test

After making a reference measurement use the following procedure to measure the insertion loss of the fiber under test:

1. Using suitable jumpers and adapters to connect the fiber under test between the output of the light source and the input of the power meter.
2. Press the **SET-UP** direct access key to display the OTS TEST SETUP window.
3. In the power meter configuration menu select dBr as the measurement unit.
4. Press the **RESULTS** then the <Source> softkey.
5. Press the <Laser On> (or <LED on>) softkey.
   The resulting measured power is displayed on the power meter and corresponds to the insertion loss of the fiber under test.

Source Specific Functions

Using variable power (with laser source only)

The output power of the laser source can be modified between 0 and -10 dBM typically. To modify the output power:

1. Press the SET-UP direct access key to display the OTS TEST SETUP window.
2. In the laser source configuration menu select CW as the transmission mode.
3. Select Variable for the output power.
4. Press the RESULTS direct access key to display the OTS Results window.
5. From the OTS Results window press the <Source> softkey then the <Laser On> softkey.
6. Use the ↑ et ↓ arrow keys to select the required output power.

Scanning Mode

In the scanning mode the Light source alternately transmits on the two wavelengths every 10 seconds. To use the scanning mode:

1. Press the **SET-UP** direct access key to display the OTS TEST SETUP window.
2. In the Light source configuration menu select Yes for the Scanning menu option. The CW transmission mode is automatically selected when Scanning is enabled.

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3. Press the **RESULTS** direct access key to display the OTS Results window.
4. From the OTS Results window press the <Power meter> softkey to access the power meter functions of the OTS.
5. Use the <Wavelength> key to select the AUTOLAMBDA mode.
6. Press the <Return> key, then the <Source>, then the <Laser On> (or <LED on>) softkey.

   The Light source provides a graphical display of the two sources and indicates which one is connected to the output during the scanning process. The power meter automatically switches to the source wavelength and displays the resulting power measurement.

Transmission of modulated signals

In order to easily identify a fiber under test the Light source can transmit a modulated signal that can be identified by the power meter. This ensures that two users at the extremities of a fiber link are connected to the same fiber. To use this function:

1. Press the **SET-UP** direct access key to display the OTS TEST SETUP window.
2. In the Light source configuration menu select the required modulated signal frequency for the Mode menu option. The following frequencies are available: 270Hz, 330Hz, 1KHz and 2 KHz.
3. From the OTS Results window press the <Source> softkey to access the Light source functions of the OTS.
4. Press the <Laser On> (or <LED on>) softkey.
   The source transmits a modulated signal on the fiber. If the power meter is connected to the same fiber as the source the selected modulation frequency is displayed in place of the measured power indication. For example, if a 2KHz modulated signal is detected by the power meter the measured power is replaced by 2000 Hz.

Power meter Specific Functions

Memory Functions

The power meter of the OTS module contains a memory which can contain up to 300 measurement results.

The stored results are displayed in a table format with each line corresponding to a measurement result. The columns for each measurement gives the following information:

- the number of the tested fiber
- the date and time of the measurement
- the wavelength
- the power measured in dBm
- the power mesured in dBr
- the level of the chosen reference (if unity= dBr)
- the transmission mode of the measured signal: continued or modulated at a frequence of 270Hz, 330Hz, 1KHz, or 2KHz.

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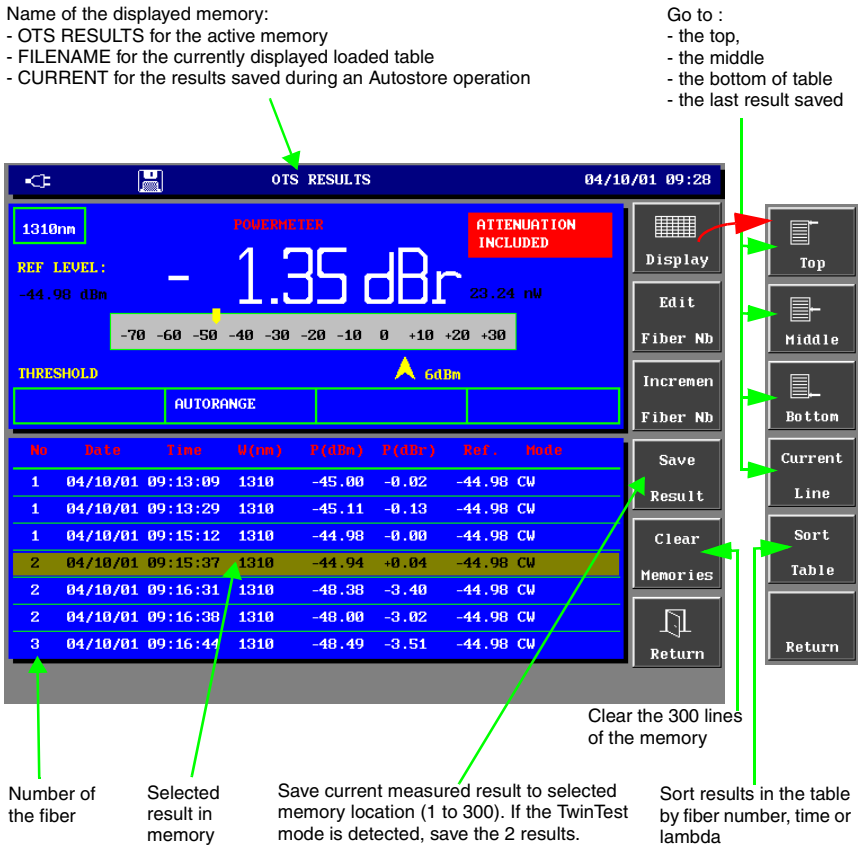
- To access the memory functions press the <Memories> key. The following memory functions are displayed.


Name of the displayed memory:
- OTS RESULTS for the active memory
- FILENAME for the currently displayed loaded table
- CURRENT for the results saved during an Autostore operation
Go to :
- the top,
- the middle
- the bottom of table
- the last result saved
OTS RESULTS
04/10/01 09:28
1310nm
POWERMETER
ATTENUATION INCLUDED
REF LEVEL:
-44.98 dBm
- 1.35 dBr
23.24 nW
-70 -60 -50 -40 -30 -20 -10 0 +10 +20 +30
THRESHOLD
6dBm
AUTORANGE
No Date Time W(nm) P(dBm) P(dBr) Ref. Mode
1 04/10/01 09:13:09 1310 -45.00 -0.02 -44.98 CW
1 04/10/01 09:13:29 1310 -45.11 -0.13 -44.98 CW
1 04/10/01 09:15:12 1310 -44.98 -0.00 -44.98 CW
2 04/10/01 09:15:37 1310 -44.94 +0.04 -44.98 CW
2 04/10/01 09:16:31 1310 -48.38 -3.40 -44.98 CW
2 04/10/01 09:16:38 1310 -48.00 -3.02 -44.98 CW
3 04/10/01 09:16:44 1310 -48.49 -3.51 -44.98 CW
Display
Edit Fiber Nb
Incremen Fiber Nb
Save Result
Clear Memories
Return
Top
Middle
Bottom
Current Line
Sort Table
Return
Clear the 300 lines of the memory
Number of the fiber
Selected result in memory
Save current measured result to selected memory location (1 to 300). If the TwinTest mode is detected, save the 2 results.
Sort results in the table by fiber number, time or lambda

Display of the Memories

Sorting the results in the memory

After pressing the <Display> key, the <Sort Table> gives access to the different memory sorting options in the displayed table:

- by fiber number (then by wavelength)
- by date
- by wavelength (then by fiber number)

Moving about in the memory

After pressing the <Display> key, the following functions are available:

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- the <top> key moves the display window to the first set of memorised results in the table
- the <Middle> moves the display window to the middle of the memorised results in the table
- the <Bottom> moves the display window to the end of the memorised results in the table
- the < Current Line> moves the cursor to the last memorised result.

Editing the fiber number

The <Edit Fiber Nb> key enables the modification of the fiber number for the selected result.

If this number is modified in the Memory menu, then it is automatically updated in the Configuration menu accessed by the **File** button. Conversely, if a new fiber number is entered in the File menu, it will be used when the results are next stored in the memory.

Incrementing the fiber number

The <Incremen Fiber Nb> key increases the number at the next save. This number is also incremented in the Configuration menu accessed by the File button.

Saving the current measurement result

To save the currently displayed measurement result (or, if the TwinTest mode is detected, the two corresponding results):

1. From the OTS Results window press the <Memories> key, then the <Display> key.
2. Use the <Top>, <Middle>, <Bottom>or <Current Line> key in conjunction with the ↓ and ↑ directional arrows to select the memory location to store the result.
3. Press the <Save Result> key.

The current measurement is saved in the selected line of the memory (and in the following lines in the TwinTest mode).

Automatic result storage

The power meter can automatically save up to 300 results at predefined intervals while Run is executed with the **STOP/START** direct access key. When this key is pressed to stop the execution the File window is automatically displayed to save the results in a file.

Use the following procedure to automatically store results:

1. Press the **SET-UP** direct access key to display the OTS TEST SETUP window.
2. In the Powermeter menu select: mode / Autostore.
3. Select the time interval with the Time Auto menu option, 1 second to 11 hours 59 minutes and 59 seconds in 1 second increments.
4. Press the **RESULTS** direct access key then the <Memories> softkey to display the memories.

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5. Press the **START/STOP** direct access key to execute the automatic result storage sequence.

Note

It is possible to integrate manual storage to an automatic storage.To do this the cursor must be positioned on the last line of the memory. Then the <Store Results> key appears. Each time this key is pressed the current result is saved.

Note

If the cursor is positioned on the last line loaded in memory, it is repositioned after each save to remain on the last line. If not it remains on the last line.

6. The sequence is stopped either when the **START/STOP** key is pressed to stop the execution or when 300 results have been saved. The File window is automatically displayed at the end of the sequence so that the results can be saved in a file (Refer to "Manipulating stored data" on page 8-16 for a full description of the MTS^e file management).

Saving the memory in a file

When the **START/STOP** key is pressed to stop the execution or at the end of the automatic result storage, the File window is automatically displayed so that the memorized results can be saved in a file.

This file has the extension .OTS.

- Select the media (see page 8-1)
- Select the file naming mode and the file name (see page 8-2, page 8-7 and page 8-8)
- Press the <Save> key.

Loading memorized results

1. Find the file as described page 8-18.
2. Press the **<**Load**>** then the <Table> key.

Automatic result printing

The power meter can automatically print results at predefined intervals while Run is executed with the **STOP/START** direct access key.

Use the following procedure to automatically store results:

1. Make sure a printer is connected to the printer port.
2. Press the **SET-UP** direct access key to display the OTS TEST SETUP window.
3. In the power meter configuration menu select Autoprint as the storage mode.
4. Select the time interval with the Time Auto menu option, 1 second to 11 hours 59 minutes and 59 seconds in 1 second increments.
5. Press the **RESULTS** direct access key to display the OTS RESULTS window.
6. Configure the light source and power meter with the required parameters.
7. From the OTS RESULTS window press the <Source> softkey to access the Light source functions of the OTS.
8. Press the <Laser On> (or <LED on>) softkey.

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9. Press the **START/STOP** direct access key to execute the automatic result storage sequence.
   The results are printed on the printer at the selected time interval.
10. The sequence is stopped either when the **START/STOP** key is pressed to stop the execution or when 300 results have been printed.

Choosing a non calibrated wavelength

If a Light source is transmitting on a specific wavelength the same wavelength can be selected for the power meter.

To select a specific wavelength:

1. Press the **SET-UP** direct access key to display the OTS TEST SETUP window.
2. In the power meter configuration menu select User as the Wavelength.
3. Select the require wavelength to match the source with the User Select menu option.
4. Press the **RESULTS** direct access key to display the OTS Results window. The selected wavelength is displayed on the power meter display.

Setting an audible alarm threshold

In order to easily detect a measurement result that exceeds a chosen threshold the power meter is equipped with an audible threshold alarm.

To enable the audible alarm:

1. From the OTS Results window press the <Power meter> softkey to access the power meter functions of the OTS.
2. Press the horizontal arrow keys to get the required alarm level (or, in the power meter configuration menu, select the alarm threshold level).
3. Press the <Thre. On> to enable the audible threshold alarm.
4. Press the <Thre. Of> to disable the audible threshold alarm.

Note

The alarm threshold can also be selected in the Test Set-up menu.

Transferring OTS table to Excel

See in chapter 8 how to save results in a file and how to transfer OTS table of results on Excel (see page 8-11).

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Chapter 7

Optical spectrum analyser

This chapter describes the different steps in carrying out a spectrum analysis of an optical signal by an MTS equipped with a WDM 507x module:

- ❏ OSA configuration test
- ❏ Display of spectrum and results of the WDM analysis

Configuration of the instrument

After connecting the fiber to be tested to the optical connector, you must select the OSA module (see "Instrument Set up" on page 3-11), then setup this module.

OSA test setup

To setup the MTS^e for an OSA test on a fiber, press the **SET-UP** button then the <Test setup> key. The different measurement parameters are displayed.

You may :

1. either choose the default values by pressing the key <Auto Mode>.

   Auto Mode Configuration:
   - Sweep : Continue
   - High Sensitivity: No
   - Resolution : Full
   - Channel Detection: First sweep
   - Signal Threshold: Auto
   - Statistic Mode: No
   - SNR Methode : Left & Right.
   - S <-> N Distance: Auto
   - Noise Acq. BW: 0.100 nm.
   - Start Screen: Auto

2. or define your own configuration.
   The parameter to be modified must be chosen by using the direction arrow keys «↓» and «↑». The screen will then display the possible options: use the direction arrow keys ← and → to make a choice.

The different parameters proposed are described below.

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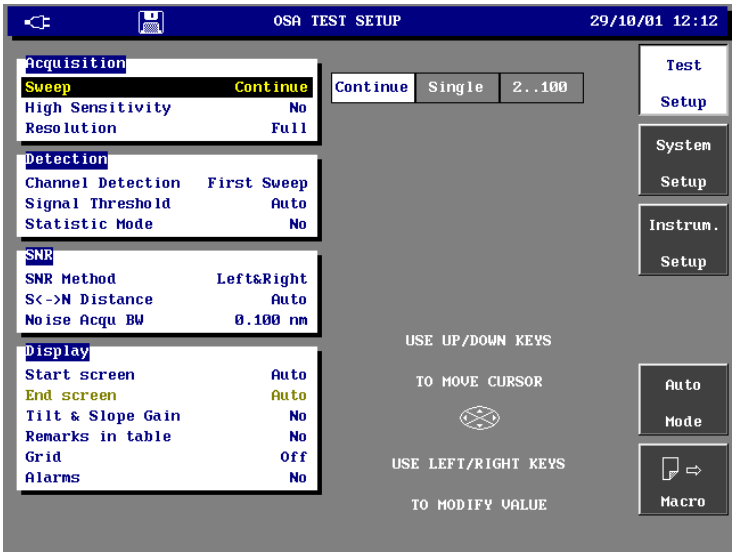

OSA CONFIGURATION TEST

Acquisition parameters

Note

When a channel power is higher than10 dBm or when the composite power of the input signal is higher than20 dBm, a warning is displayed and the signal is cut off.

Sweep

Continuous — Every two seconds there will be a measurement with a trace refresh and a real-time display of the results and statistics on these results.

Single — There will only be one measurement and a display of the results.

2. .100 — Number of acquisitions required from 2 to 100.

High Sensitivity

No — Power scale ranges from +15 to - 65 dBm.

Yes — Power scale ranges from - 25 to - 75 dBm.

Resolution

Full — Maximum filter resolution (<0.1 nm).

0.1 / 0.2 / 0.3 / 0.4 or 0.5 nm.

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Detection parameters

Channel Detection[1]

1st swap Channels of the first measurement serve as a detection reference.

Grid Manual, ITU and Auto grid serve as a detection reference.

Note The grid selection has priority on the "Channel Detection". For example it is not possible to choose Channel Detection = Grid, if the grid option is Off or Convent.

Signal Threshold[1]

Channel detection threshold (see "Threshold of channel detection" on page 7-7).

Auto Threshold is automatically determined.

Manual from -79.9 to + 20 dBm.

Statistic Mode

Yes / No To use or not to use statistics.

Note A change in the «Channel Detection» and «Signal Threshold» parameters will be only transferred to the trace, if the used WDM module is the one used for acquisition.

Signal/Noise parameters

SNR Method[1]

Side of the peak where the reference point for the noise is taken (Left, Right, Left & Right).

S<-> N Distance[1]

Distance between the channel peak and the reference point for the noise.

Auto distance determined according to the interval (space) between channels.

at 0.2/ 0.4 / 0.8 nm if the unit is nm
(or at 25 GHz, 50 GHz, 100 GHz if the unit is THz)
of the value corresponding to the peak.

Noise Acqu BW

Reference bandwidth used for noise acquisition:

- standard 100 pm

- values ranging from 10 pm to 10 000 pm.

1. Caution: every change in this parameter is immediately transferred to the trace, leading to the loss of the statistics.

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Results display parameters

Start screen[1]

Start of display.

Auto	Automatic detection of start of display depending on the channels detected. Start and end of displays are set automatically.
Full	Start of display at 1525 nm (for a 5071 WDM module).
Manual	Start of display manually chosen.

End screen[1]

Auto	Automatic detection of end of display.
Full	End of display at 1570 nm (for a 5071 WDM module).
Manual	End of display manually chosen.

Tilt and Slope gain

No / Yes	Validates measurement and display of max. difference of gain (in dB) and slope of gain (in dB by nm or by THz) above the trace.

Remarks in table

No / Yes	Allows display and entry of notes in table ("Table remarks" on page 7-11).

Grid

Four different types of grid are available in the Display window of the menu:

Off	No grid.
Convent.	The grid coincides with the graduations. The interval therefore varies according to the zoom level.
ITU	Press the <Set grid> key to access the ITU grid choices. Two keys allow to have the ITU grid either only between the A and B cursors or on the whole band. Three lines in the menu allows the followings choices: - ITU reference channel, - interval (space) between channels: 50, 100 or 200 GHz. - number of channels: 1 to 100.
Manual	Press the <Set grid> key to access a choice of the following grid elements: - first channel - interval between channels:

1. The channels which are out of the screen limits are not in the result table.

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from 50 to 400 GHz by steps of 5 GHz, or
from 0.160 to 8.000 nm by steps of 0.001nm.
- number of channels.
The <Between A and B> key allows to have only between the cursors the grid with the defined spacing .

AUTO — The AUTO grid is lined up to the present channels whatever are their interval. To get this grid the option «1st sweep» has to be selected on the «Channel Detection» line. The Grid line and the Auto option being selected, press the <Save Ref> key to take as grid reference the location of the detected channels.

Alarms

The results whose standard deviation exceeds a chosen threshold may be displayed in red in the table.

To define the alarm thresholds:

- select the Alarms line and press the <Set Alarms> key. The alarms selection menu is displayed.
- Assign Yes to the chosen alarm: the direction arrow keys "<" and ">" allow you to choose the corresponding threshold value.

According to the chosen statistic, three alarms are possible on:

Delta L (or F):	threshold from 0.01 to 4.01 nm (or from 1 to 500 GHz)
Delta P:	threshold from 0.1 to 10.0 dB
Delta SNR:	threshold from 0.1 to 10.0 dB

Display of WDM results

The results screen obtained by pressing the **RESULTS** button, presents zones from the top to bottom displaying:

- the file name (if the result is stored in the memory).
- characteristics specific to WDM test: module name, resolution used (Res), number of acquisitions used for the statitics (Acq), signal threshold (Th), distance chosen for the S<->N ratio, fiber number (N:), date and time of acquisition.
- the trace (see "Trace" on page 7-6).
- the results associated with the A and B cursors of the trace, the type of channels displayed, the composite power and the total power.
- the results table (see "Table" on page 7-9).

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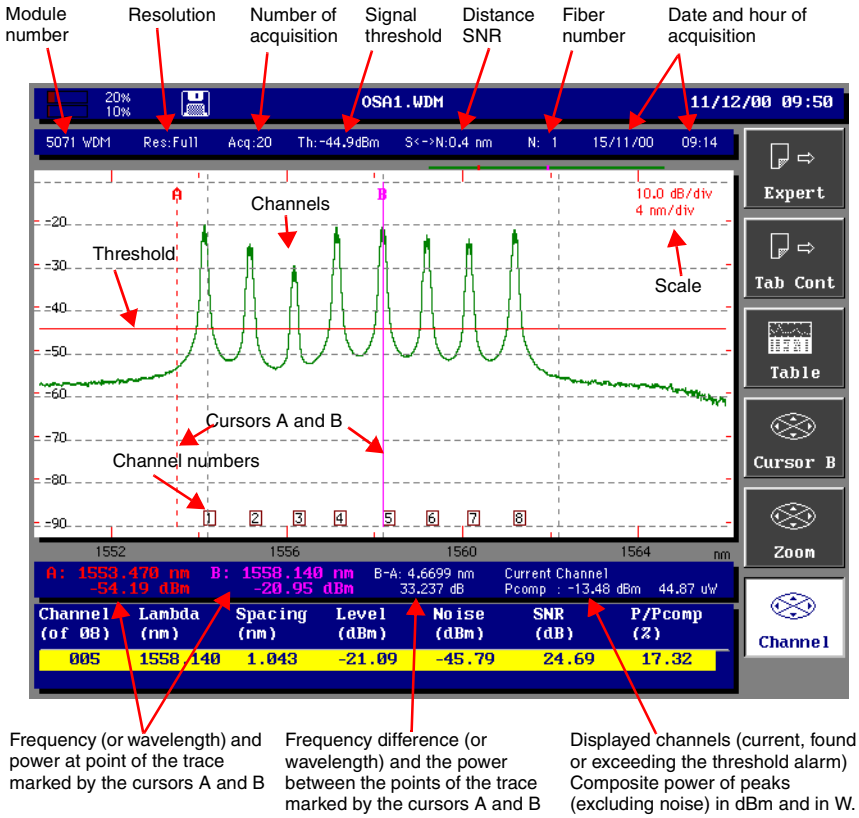

Example of an OSA test result (with grid)

The <1/2 tabl.> / <Table> / <Trace> key (or the **RESULTS** button) is used to obtain:

- either a a scaled-down display of the trace, but with 5 to 8 lines of the table (depending on whether the table remarks are displayed or not).
- either the table only.
- or the main display of the trace with only one line of the table at the bottom of the page.

Trace

The trace represents the power (in dBm) according to the frequency (in THz) or the wavelength (in nm). The detected channels are represented by peaks.

Note

When several acquisitions are made, the trace corresponding to the last acquisition is displayed.

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Cursors

To move the A (or B) cursor by pressing the cursor key, first display <Cursor A> (or <Cursor B>), then use the < or > arrow keys.

To move both cursors simultaneously, press the cursor key to display the <Curs. AB> key, then use the < or > arrow keys.

The coordinates of the intersection point of the cursors with the trace are indicated underneath the trace as well as the frequency difference (or the wavelength) and the power between these points.

Trace shifting

To shift the trace horizontally or vertically, press the <Shift/Zoom> key to display <Shift>, then use the direction arrow keys to make the required shift.

Zoom

In order to zoom in on the trace, press the <Shift/Zoom> key to display <Zoom>, then use the direction arrow keys to zoom in either horizontally or vertically.

The zoom of the display is made around the selected cursor. If <Cursor AB> was selected the zoom is made at the mid point between the cursors.

Note

To reset the zoom and see the full trace, press and hold simultaneously the < and > keys.

The position of the displayed part of the trace with respect of the complete trace is located by a (grey or yellow) line on the top of the trace window.

You can also manually zoom in on a part of the trace defining the start and/or end of the screen in the OSA test-set menu (Display windows). In this case, the channels which are out of the screen limits are not in the result table.

Successive zooms on each event

- Zoom in on one of the event.
- Press the <Event> key.
- Use the < and > keys to move successively the display window on each event.

Threshold of channel detection

On the trace some peaks corresponding to a noise could be mistaken for channels. It is therefore necessary to set a power threshold level: only peaks exceeding the threshold will be considered as channels and included in the results table.

This threshold is represented by a red horizontal line on the trace:

To display this threshold or not, press the <Expert> key then the <Threshold> key:

- if the key indicates <Threshold> the threshold is displayed and can be moved using the "↑" and «↓» arrow keys;
- if the key indicates < Threshold Off> then the threshold is not displayed.

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Grid display

The display window of the trace may contain a grid to facilitate the control of the position of the channels. Several grid types are possible:

- The Conventional grid has an interval (spacing) indicated in the top right corner of the window, which varies according to the zoom level.
- The ITU grid uses a channel reference at 193,10 THz and three steps are possible for the spacing between the channels: 50, 100 or 200 GHz.
- The Manual grid can be defined by the user to correspond exactly to the channels. The position of the first vertical line must then be defined according to the wavelength of the first channel, the spacing (from 50 to 400 GHz by 5 GHz steps) and the number of intervals desired.

The grids are defined in the OSA test setup menu (see "Results display parameters" on page 7-4).

The grid may be put into service either in the OSA test setup menu, or on the Results page, by pressing the <Expert> key then the <Grid> key.

Display of total power between cursors

To display the total power between the two cursors A and B on the trace:

- Place the cursors.
- Press the <Expert> key, then the <Manual> key, and finally the <T Power A<-->B> key.
- The space between the trace and the two cursors is shadowed in grey and the power is displayed using the «P = -4.95 dBm» format.
- Press the <T power A<-->B> key a second time to remove the total power measurement result.

Display of Gain Tilt (delta) and Gain Slope results

The MTS^e allows for the display of two additional results:

- The Gain Tilt, that is to say the difference between the max. and min. peak values of the whole spectrum of the signal between the cursors.
- The Gain Slope measured by the least squares method, using a linear regression algorithm.

To display the results above the channels:

- In the OSA test setup menu, verify that the «Tilt & Slope gain» parameter is set on «Yes».
- Place the cursors
- Press the <Expert> key, the <Manual> key and finally the <Tilt & Slope> key.

  The Gain Tilt is displayed in dB. The Gain Slope is traced and the value is displayed in dB/THz or dB/nm depending on the chosen unit.

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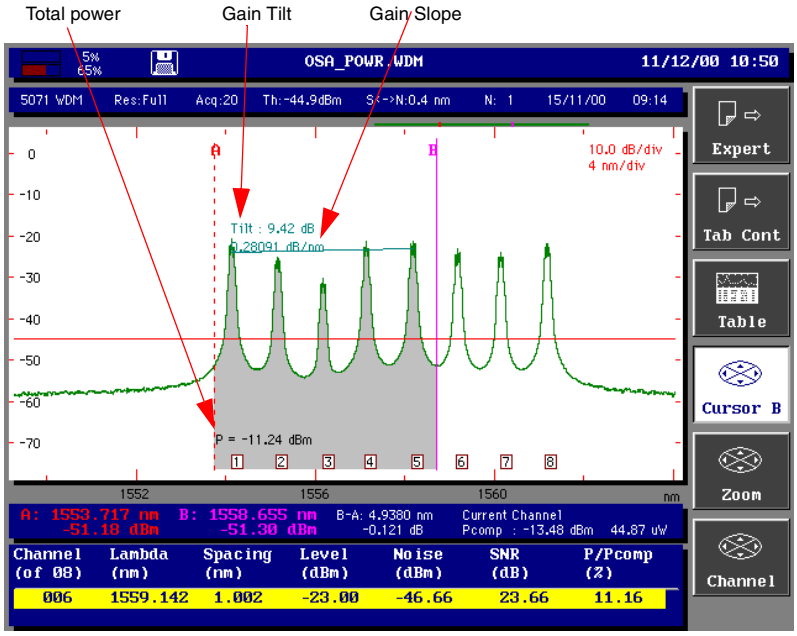

Display of total power, Gain Tilt and gain slope between the cursors

Overlay

See "Overlay of traces" on page 7-12

Table

Lines

Depending on the choice made in the Set-up menu, in the Detection window, for the «Channel Detection» parameter, the table contains:

- either one line for each detected channel, if the «1st sweep» option is selected
- or a line for each graduation if the grid option is selected.

Display type

By defect only one line of the table is displayed below the trace.

- To display 8 lines of the table, under the trace, press the <1/2 tabl> key or the **RESULTS** button.
- to display 18 lines of the table (without trace), press the <Table> key or the **RESULTS** button.
- to display again the trace with only a line of the table, press the <Trace> key or the **RESULTS** button.

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Table contents without statistics

In the absence of statistics (see "Detection parameters" on page 7-3), the parameters given for each channel are as follows:

1. Channel number (the total number of channels is given in the first column header).
2. Frequency or wavelength (Lambda) of the channel according to the chosen unit.
3. Spacing between the channels in THz or nm.
4. Power level of the channel in dBm.
5. Noise level in dBm.
6. S/N ratio for the channel in dB.
7. Relationship between channel power and composite power (P/Pcomp) in %.

Table contents with statistics

If the test involves multiple acquisitions (2..100 mode or Continuous mode), then statistics are conducted on the results. To display these results in the table, press the <Cont Tab> key, then the <Statist.> key.

Five "Statistics" keys are then available to choose what will be displayed in the table for each channel:

Key	Table Contents						
No statist.	Channel	Freq. or Lambda	Spacing	Level	Noise	SNR	P/ P comp
Freq or Lambda Statist.	Channel	Freq. or Lambda	Spacing	F or L Avg	F or L max	F. or Min L.	Sdev [a] F or L
Level Statist.	Channel	Freq. or Lambda	Level	Avg. P.	Max P.	Min P.	Sdev P
Mixed Statist.	Channel	Freq. or Lambda	F or L min	F or L Max	Level	P min	P Max
Statist. SNR	Channel	Freq. or Lambda	SNR	Avg. SNR	Max SNR	Min SNR	Sdev SNR

a. Standard deviation

Press the <Exit> key to leave the Statistics menu.

Channel sort

The channels can be classified in the table in ascending order according to frequency (or wavelength), level or S/N ratio.

To modify this order:

- Press the <Cont Tab> key, then the <Sort> key.
- Press the <Freq sort> key (or <Lambda sort> depending on the chosen unit), <Level sort> or <SNR sort>.

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Successive addressing of channels according to the chosen sort

On the trace and in the table, it is possible to make the cursor successively pass on the channels according to the selected sort order. To do this:

- Use the cursor key to choose the cursor A or B for use on the trace.
- Press the <Channel> key.
- Press on the > or < key to make the cursor jump back to the previous channel or on to the following channel:
  - with the frequency sort, the cursor follows the normal order of channels.
  - with the level sort, the cursor follows the order of the channel levels.
  - with the SNR sort, the cursor follows the order of S/N ratios.

Table remarks

A remark with the maximum of 40 characters, entered by the user, can be associated with each channel. For each trace, a maximum of 16 remarks is possible.

Notes

These remarks appear in the table if they have been validated in the «OSA test setup» menu on the Remarks in table line (Display window).

Note

Each remark is associated with a channel. Therefore, if the channel is erased, then the remark will also be erased.

To enter a remark:

- Press the **SET-UP** button, then the <Test Setup> key.
- In the Results window, in the Remarks in table line, select Yes.
- Press the **RESULTS** button and, if necessary, on the <Table> key to return to the Table display.
- In the table, select the channel.
- Press the <Expert> key, then the <Notes> key.
- Enter the text of the note by using the edit menu which is displayed (see "Editing" on page 4-5).
- Press the <Exit> key.

Display of relative results

The table usually gives the results in absolute values. To obtain these results as relative values, that is with respect to the reference channel, do the following:

- Press the <Tab Cont> key, then the <Absolute Result> key: this key will then indicate <Relative Result>.
- Move the cursor on to the channel that must be used as the reference.
- Press the <Set Ref Channel> key. The results are then recalculated in relation to the reference channel.

Current channels- found channels

If the test initiates multiple acquisitions (2..100 mode or Continuous mode):

- the number of «found channels» is registered with the first acquisition and the position of the channels is stored.

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- during the following acquisitions, the detected channels or «current channels» are not necessarily the same as the channels found with the first acquisition.

To choose the channels to be displayed, use the <Current Channels> / <Found channels> key.

Displaying in red the results exceeding alarm thresholds

To display in red in the table the results exceeding the alarm thresholds that have been chosen in the OSA test setup menu, proceed as follows:

- Press the <Cont Tab> key, then the <Current channels> / <Found channels> key until <Alarm channels> is displayed.

Overlay of traces

This Overlay Trace function which allows two traces to be displayed simultaneously on the screen is very useful to compare either the acquired spectrums from different fibers of the same cable, or to know how the spectrums from the same fiber evolve over time.

For this, the instrument has an overlay memory in which the trace to be superimposed on the current trace must be stored. This memory can be used to store either:

- the current trace to compare it with traces which will be acquired in the future.
- a reference trace previously saved on a floppy disk or in internal memory, to compare it with the current trace.

Overlaying a trace

Overlaying the current trace

To copy the current trace in overlay memory, do as follows:

- On the trace display screen, obtained by pressing the **RESULTS** key, press the <Expert> key, then the <Overlay>, and finally the <Set overlay> key.

  The current trace copied in overlay memory is represented by a pale line (or, with a colored screen, in blue) which is automatically offset with respect to the current trace.
- a new acquisition can then be started to compare the new trace with the one being overlaid.

Transferring a stored trace to the overlay memory

1. Select the trace to be put in the overlay memory by using the procedure described in "Finding files" on page 8-18.
2. Press the <Load> key, then the <Overlay> key.

   The selected trace is then put in the overlay memory: it is represented by a pale (or blue) line and is automatically offset with respect to the current trace. It can be compared with the current trace.

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Possible actions after overlaying a trace

Returning to a single trace display

When two traces are displayed, press the <Remove> key to remove the overlay trace and display only the current trace.

The softkey <View 2 curves> allows you to recall the last overlay trace so that you can have both traces on the screen again.

The trace transferred to overlay memory is stored there and can therefore be recalled at any time until a new trace erases it.

Removing the Y offset (shift) between traces

To superimpose the overlaid trace and the current trace, press the <Adjust Y> key: the vertical offset (shift) of the traces is removed at the level of the selected cursor.

Swapping traces

The measurements can only be carried out on the current trace and not on an overlay trace. To make measurements on an overlaid trace, you have to exchange it with the current trace. To do this, press the <Swap> key.

Shifting the current trace

To vertically shift the current trace of the overlaid trace which remains fixed, press the <Exit> key twice to exit the overlay mode and the Expert mode, press the <Cursor> key, then use the ↑ or ↓ arrow keys.

Shifting of the two traces

To simultaneously shift the current trace and the overlaid trace, press the <Zoom/Shift> key to go to Shift mode, then use the ↑ and ↓ arrow keys.

Trace resulting from the difference between the compared traces

When two traces are simultaneously displayed, it is possible to obtain the trace corresponding to the difference, point by point, between the current trace and the overlaid trace.

To do this, press the <2 Traces Diff.>. key. The screen then displays the overlaid trace and the trace resulting from the «Difference».

It is then possible to recall the current trace and to erase the «Difference» trace by pressing the <Main trace> key.

Exiting the overlay menu

To exit from the overlay menu, press the <Exit> key.

Saving and transferring the results to Excel

To save the test results and transfer them to Excel, proceed as indicated in chapter 8.

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Chapter 8

File management

This chapter describes the following file management functions:

- ❏ Choosing the storage medium
- ❏ Storing data
- ❏ Using stored data (loading traces, copying and deleting a file)
- ❏ Automatic and manual file naming
- ❏ Overlaying traces
- ❏ Formatting a floppy disk

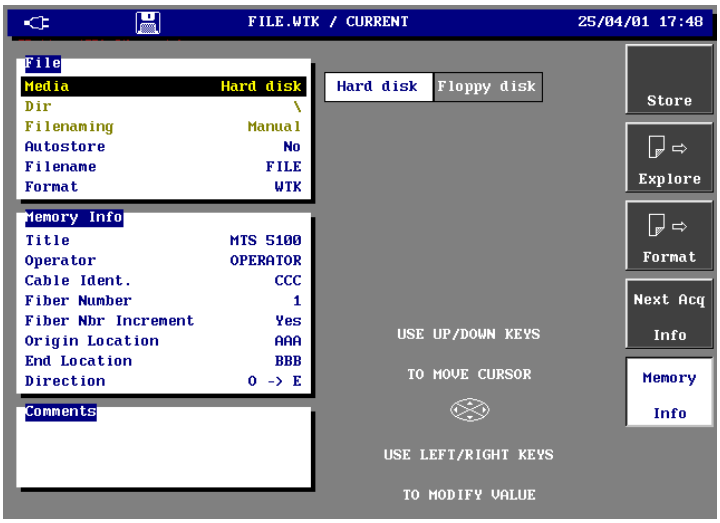
Storage media

For storing and recalling acquisition data MTS^e is equipped with the following:

- an internal RAM memory or an optional hard disk
- an optional high density (HD) MS-DOS compatible 3.5″ floppy disk drive.

Selecting the storage location

- Press the **FILE** key.
  The File manager window appears.



File Manager Window (example with OTDR module)

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- In the File window, with the directional keys, select the Media/Dir option, then the support: Internal or Floppy Disk or Hard Disk (options).

When the Media line is selected, the key <Format> is available to format the selected media (see "Formatting" on page 8-23).

Storing data

Use the following procedure to store the acquired data (trace and result table displayed on the screen):

1. Press the **FILE** key, then select the storage medium.
2. If the file must be stored in a directory, press the <Explore> key, select the directory then press the <Exit> key to return to the file menu.
3. Choose either the automatic storage after acquisition, or the manual storage.
4. Choose the required file naming mode, Manual or Automatic (see "Filename" on page 8-2). If the auto storage is selected, then the file naming must be auto or semi-auto. If not, a warning asks, after each acquisition, if the previous file must be deleted by the new one.
5. Choose the file format (see "OTDR file format" on page 8-11)
6. Press the <Save> key to save the trace and measurement results that are displayed on the screen to the selected medium.

Note The date specified with the file name is the date of the storage.

Filename

The filename uses the DOS format: eight characters followed by three character extension.

Different file naming

Note When a trace has been called from memory, the Filenaming option of the File menu is not available to avoid an inopportune renaming of this file.

The Filenaming option of the File menu provides the following choices:

MANUAL The name of the file must be entered by the user on the Filename line, using the menu call by the <Edit> key. This menu display the available characters (understood by the DOS system) and, in the upper part the name being entered or to modify. Select the characters with the arrow keys. The <Valid Char.> key selects the character on which is the cursor; the <Delete char.> key delete it. For more details on this menu report to "Editing" on page 4-5.

If a character is entered that is not a valid DOS character, it will be ignored.

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AUTO The file name is automatically created when it is saved, conforming to the naming conventions given below.

SEMI-AUTO The file name is automatically created when it is saved, conforming a code defined by the user.

Warning concerning file naming

Note When saving in internal memory (RAM), if the first character of the identifier is a digit, it will be replaced with an A in the file name.

Note If the identifier is in lower case, the three characters will be converted to upper case.

Note If the identifier contains less than three characters, the missing characters will be replaced with Xs.

OTDR Module Automatic Filenaming

When you store a data to disk using automatic file naming, the filename is automatically created using the following file naming conventions:

OTDR module automatic file naming: `cccffwps`		
ccc		First three characters of the Cable Id, defined in the Identifiers section of this menu
ff	0 to 99 Ao to YZ	Fiber number decimal code alphanumeric code (100 to 999)
w		Acquisition laser wavelength used for the measurement
	3	1310 nm
	5	1550 nm
	6	1625 nm
	8	850 nm
	9	1300 nm

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OTDR module automatic file naming: cccffwps		
p		Pulsewidth used for the measurement*
	A	3 ns
	B	5 ns
	C	10 ns
	D	20 ns
	E	30ns
	F	100ns
	G	200ns
	H	300 ns
	I	500 ns
	J	1 µs
	K	3 µs
	L	10 µs
	M	20 µs
s		Direction
	O	origin to extremity
	E	extremity to origin

* the available values are depending on the module used.

When a stored curve is displayed on the screen the filename is indicated in the display title bar.

OTDR Module Semi-Automatic Filenaming

The semi-auto Filenaming, being selected:

- move the cursor on the line Filename.
- Press the <Edit> key. The following editing menu appears:

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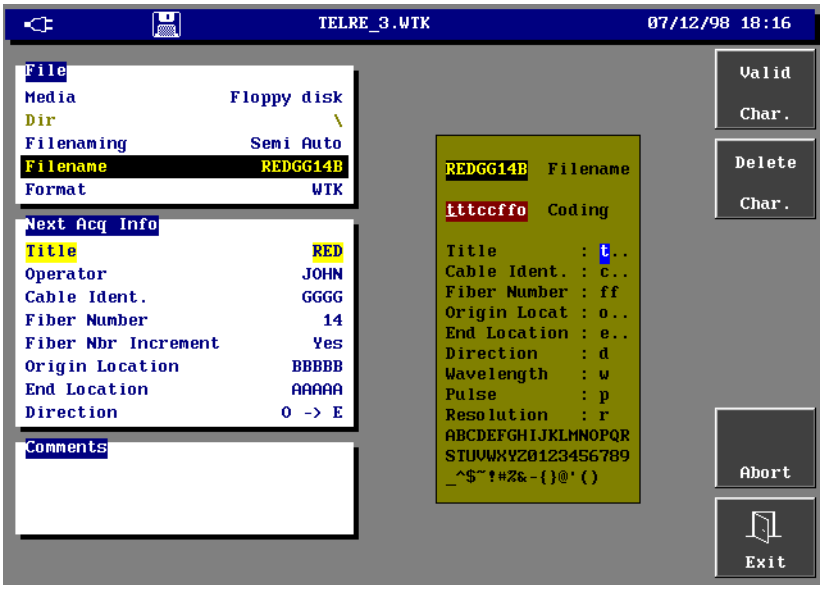

Semi-auto file naming edition

- On the Coding line of the editing menu, define the filename code. For that, move the cursor on the different line of the menu (in the order you wish for the coding) and enter the corresponding characters pressing the <Valid Char.> key.
- On the Title line, enter as much «t» as you want of characters of the title in the filename. In the above example, 3 «t» has been entered to start the coding, then the 3 first letters of the title began the filename.
- On the Cabl. Ident., Origin and Extremity lines enter as «c», «o» or «e» as you want of characters of the concerned identification in the filename.
- On the Fiber Number line, the 2 ff are imperative for the fiber number is always coded on two characters (see table below). If, after the coding, a f is remove in the coding, only the last figure of the fiber number will be in the filename.
- To code Direction, Lambda, Pulse and Resolution only one character is necessary: see the following table.
- The semi-automatic coding can also include fixed characters, different from coding parameter characters and selected, as in Manual Filenaming, in the list located on the 3 last lines of the editing menu.

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Attention

when you leave the semi-automatic mode for another mode, the coding is lost.

OTDR module semi-automatic file naming		
t...		First characters of the title
c ...		First characters of the cable identification defined in the File windows
ff		Fiber number
	o to 99	decimal coding
	Ao to YZ	alphanumeric coding (100 to 999)
o ...		First characters of the origin location
e ...		First characters of the extremity location
d		Direction
	O	origin to extremity
	E	extremity to origin
w		Laser wavelength used for the measurement *
	3	1310 nm
	5	1550 nm
	6	1625 nm
	8	850 nm
	9	1300 nm
p		Pulse *
	A	3 ns
	B	5 ns
	C	10 ns
	D	20 ns
	E	30 ns
	F	100 ns
	G	200 ns
	H	300 ns
	I	500 ns
	J	1 µs
	K	3 µs
	L	10 µs
	M	20 µs

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OTDR module semi-automatic file naming		
r		Resolution *
	0	4 cm
	1	8 cm
	2	16 cm
	3	32 cm
	4	64 cm
	5	125 cm
	6	250 cm
	7	5 m
	8	10 m
	9	20 m
	10	40 m
	A	80 m
	B	160 m
	D	320 m

* the available values are depending on the module used.

OTS Module Automatic Filenaming

When you store an OTS data to disk using automatic file naming, the file name is automatically created using the following file naming conventions :

OTS module automatic file naming: `cccffwps`		
ccc		First characters of the cable identification defined in the File windows
ff	o to 99 Ao to YZ	Fiber number decimal coding alphanumeric coding (100 to 999)
w		Laser wavelength used for the measurement *
	3	1310 nm
	5	1550 nm
	8	850 nm
	A	AUTO
	U	USER

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OTS module automatic file naming: cccffwps		
r		Range
	M	mW manual range
	U	µW manual range
	N	nW manual range
	A	Auto range
s		Direction
	O	origin to extremity
	E	extremity to origin

* the available values are depending on the module used.

OTS Module Semi- Automatic Filenaming

When you store an OTS data to disk using semi-automatic file naming, the file name is created using the file naming conventions selected by the user as follows:

- Move the cursor on the Filename line.
- Press the <Edit> key. The Editing menu appears.

  On the Coding line of the editing menu, define the filename code. For that, move the cursor on the different line of the menu (in the order you wish for the coding) and enter the corresponding characters pressing the <Valid Char.> key.
- On the Title line, enter as much «t» as you want of characters of the title in the filename.
- On the Cabl. Ident., Origin and Extremity lines enter as «c», «o» or «e» as you want of characters of the concerned identification in the filename.
- On the Fiber Number line, the 2 ff are imperative for the fiber number is always coded on two characters (see table below). If, after the coding, a f is remove in the coding, only the last figure of the fiber number will be in the filename.
- To code Direction, Lambda, Pulse and Resolution only one character is necessary: see the following table.
- The semi-automatic coding can also include fixed characters, different from coding parameter characters and selected, as in MANUAL file naming, in the list located on the 3 last lines of the editing menu.

OTS module semi-automatic file naming		
t ...		First characters of the title
c ...		First characters of the cable identification defined in the File windows

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OTS module semi-automatic file naming		
ff	0 to 99 Ao to YZ	Fiber number decimal coding alphanumeric coding (100 to 999)
o ...		First characters of the origin location
e ...		First characters of the extremity location
d		Direction
	O	origin to extremity
	E	extremity to origin
w		Laser wavelength used for the measurement *
	3	1310 nm
	5	1550 nm
	8	850 nm
	9	1300 nm
	A	AUTO
	U	USER
r		Range
	M	mW manual range
	U	µW manual range
	N	nW manual range
	A	Auto range
m		Real time / Averaging
	M	averaging
	T	real time

* the available values are depending on the module used.

WDM Module Automatic Filenaming

When you store an WDM data to disk using automatic file naming, the file name is automatically created using the following file naming conventions :

WDM module automatic file naming: `cccpppff`		
ccc		First characters of the cable identification defined in the second windows of the File menu.
ppp		First characters of the test point name

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WDM module automatic file naming: cccpppff		
ff		Fiber number
	o to 99	decimal coding
	Ao to YZ	alphanumeric coding (100 to 999)

WDM Module Semi-Automatic Filenaming

When you store an WDM data to disk using semi-automatic file naming, the file name is created using the file naming conventions selected by the user as follows:

- Move the cursor on the Filename line.
- Press the <Edit> key. The Editing menu appears.

  On the Coding line of the editing menu, define the filename code. For that, move the cursor on the different line of the menu (in the order you wish for the coding) and enter the corresponding characters pressing the <Valid Char.> key.
- On the Title line, enter as much "t" as you want of characters of the title in the filename.
- On the Cabl. Ident., Origin and Extremity, Test point lines enter as «c», «o», «e» or «p» as you want of characters of the concerned identification in the filename.
- On the Fiber Number line, the 2 ff are imperative for the fiber number is always coded on two characters (see table below). If, after the coding, a f is remove in the coding, only the last figure of the fiber number will be in the filename.
- To code the Resolution only one character (from 0 to 5) is necessary: see the following table.
- The semi-automatic coding can also include fixed characters, different from coding parameter characters and selected, as in MANUAL file naming, in the list located on the 3 last lines of the editing menu.

WDM module semi-automatic file naming		
t ...		First characters of the title
c ...		First characters of the cable identification defined in the File windows
ff		Fiber number
	o to 99	decimal coding
	Ao to YZ	alphanumeric coding (100 to 999)
o ...		First characters of the origin location
e ...		First characters of the extremity location
p ...		First characters of the test point name

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WDM module semi-automatic file naming		
r	0 1 2 3 4 5	Resolution Full 0.1 nm 0.2 nm 0.3 nm 0.4 nm 0.5 nm

File format

OTDR file format

The Format option of the FILE menu provides the following file format choices, when an OTDR module is selected:

WTK — Wavetek format corresponding to a compressed Bellcore format, which optimizes storage space (recommended format).

SOR 1.1 — Format conforming to the Bellcore/Telcordia SR-5731 standard (issue december 1998).

SOR 2.0 — Format conforming to the Bellcore/Telcordia SR-5731 standard (issue february 2000).

OTS file format

.OTS if the OTS module is selected

Note

The OTS format can be opened by Excel™ as a tab delimited file.

WDM file format

Each time a WDM result is saved, two files are created with the following format:

.WDM: Acterna formats (compatible with the Acterna WinTrace and WinCable softwares) .

.TXT ASCII format for a possible transfer to a spreadsheet or word processing program.

Transferring MTS^e file (table) to Excel

Attention

This transfer concerns:
- OTS tables of results
- Both end measurement table of results (.oeo file) with OTDR module. It is not possible to transfer table of results of single OTDR measurement.
- table of WDM results (files .txt)

Transfer processing:

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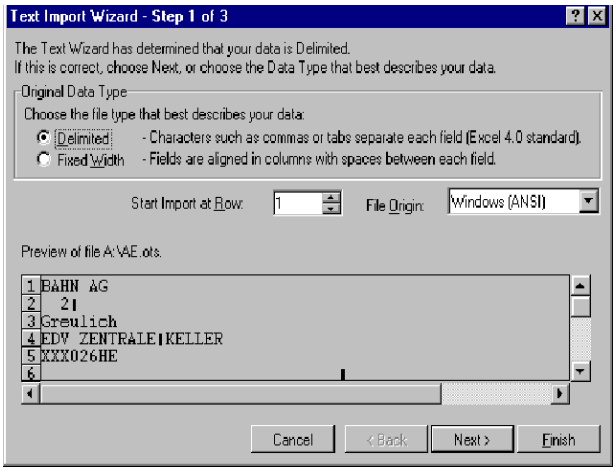
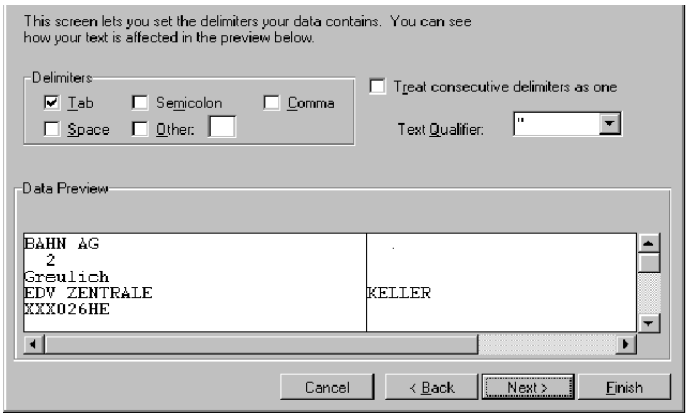
- Save the file on a floppy disk: see "Copying files from one medium to another (if available)" on page 8-21.
- Copy this file on the PC loaded with the Excel software.
- On the PC open Excel
- In the Excel window select the type of file "Text file» and open the file to transfer.
- The following window is displayed (example with an OTS file):


Text Import Wizard - Step 1 of 3
The Text Wizard has determined that your data is Delimited.
If this is correct, choose Next, or choose the Data Type that best describes your data.
Original Data Type
Choose the file type that best describes your data:
Delimited - Characters such as commas or tabs separate each field (Excel 4.0 standard).
Fixed Width - Fields are aligned in columns with spaces between each field.
Start Import at Row: 1
File Origin: Windows (ANSI)
Preview of file A:\AE.ots.
1 BAHN AG
2 21
3 Greulich
4 EDV ZENTRALE KELLER
5 XXX026HE
6
Cancel
< Back
Next >
Finish

Transferring OTS results under Excel (1)

- Select the following parameters:
  File type: Delimited
  Start import at row: 1
  File Origin: Windows (ANSI)
- Click on: Next>. The following window is displayed:



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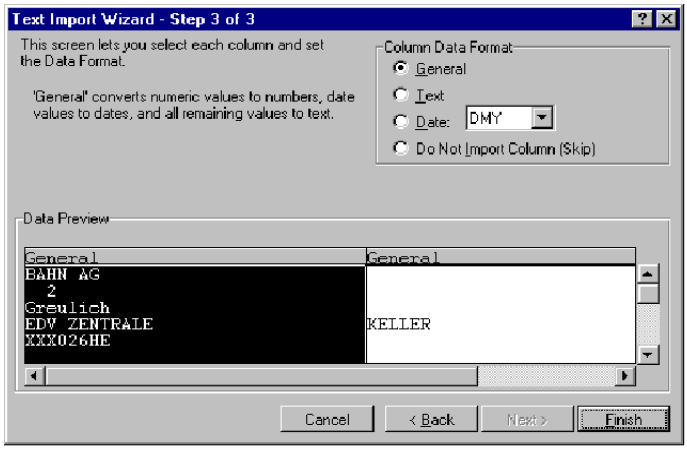
Transferring OTS file under Excel (2)

- Select the following parameters:
  Delimiters: Tab
  Text Qualifier: "
- Click on: Next>. The following window is displayed:



Transferring OTS results under Excel (3)

- Select the Column Data Format: General.
- Click on: Finish.

For OTS table

The OTS measurement results are displayed in an Excel table as follows:

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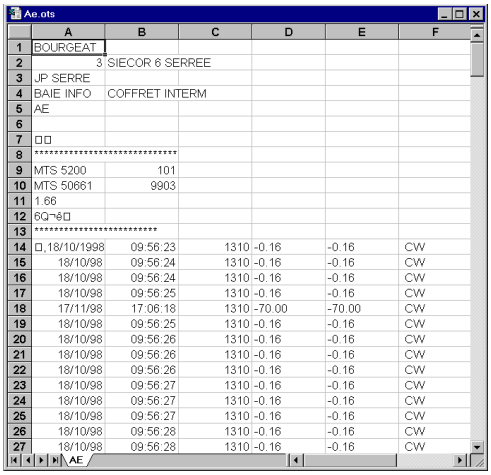


Ae.ots

	A	B	C	D	E	F
1	BOURGEAT					
2	3	SIECOR 6 SERREE				
3	JP SERRE					
4	BAIE INFO	COFFRET INTERM				
5	AE					
6						
7	□□					
8	**********					
9	MTS 5200	101				
10	MTS 50661	9903				
11	1.66					
12	6Q¬é□					
13	**********					
14	□,18/10/1998	09:56:23	1310	-0.16	-0.16	CW
15	18/10/98	09:56:24	1310	-0.16	-0.16	CW
16	18/10/98	09:56:24	1310	-0.16	-0.16	CW
17	18/10/98	09:56:25	1310	-0.16	-0.16	CW
18	17/11/98	17:06:18	1310	-70.00	-70.00	CW
19	18/10/98	09:56:25	1310	-0.16	-0.16	CW
20	18/10/98	09:56:26	1310	-0.16	-0.16	CW
21	18/10/98	09:56:26	1310	-0.16	-0.16	CW
22	18/10/98	09:56:26	1310	-0.16	-0.16	CW
23	18/10/98	09:56:27	1310	-0.16	-0.16	CW
24	18/10/98	09:56:27	1310	-0.16	-0.16	CW
25	18/10/98	09:56:27	1310	-0.16	-0.16	CW
26	18/10/98	09:56:28	1310	-0.16	-0.16	CW
27	18/10/98	09:56:28	1310	-0.16	-0.16	CW

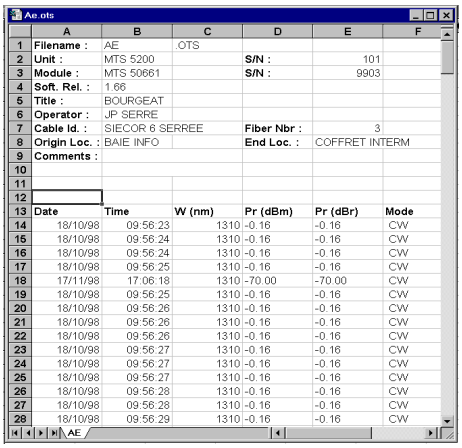
AE

OTS table under Excel

A Macro (ref macroots.xls) is available to improve the layout of the table under Excel: it adds the column title (for parameters and results). To get this macro, ask your Acterna service center.

Use of the file macroots.xls:

- Open the file "macroots.xls ", then the OTS file to display.
- In the menu bar select: Tools / Macro...
- Select the file "macroots.xls"
- Click on Run. The table is then displayed as follows:



Ae.ots

	A	B	C	D	E	F
1	**Filename :**	AE	.OTS			
2	**Unit :**	MTS 5200		**S/N :**	101	
3	**Module :**	MTS 50661		**S/N :**	9903	
4	**Soft. Rel. :**	1.66				
5	**Title :**	BOURGEAT				
6	**Operator :**	JP SERRE				
7	**Cable Id. :**	SIECOR 6 SERREE		**Fiber Nbr :**	3	
8	**Origin Loc. :**	BAIE INFO		**End Loc. :**	COFFRET INTERM	
9	**Comments :**					
10						
11						
12						
13	**Date**	**Time**	**W (nm)**	**Pr (dBm)**	**Pr (dBr)**	**Mode**
14	18/10/98	09:56:23	1310	-0.16	-0.16	CW
15	18/10/98	09:56:24	1310	-0.16	-0.16	CW
16	18/10/98	09:56:24	1310	-0.16	-0.16	CW
17	18/10/98	09:56:25	1310	-0.16	-0.16	CW
18	17/11/98	17:06:18	1310	-70.00	-70.00	CW
19	18/10/98	09:56:25	1310	-0.16	-0.16	CW
20	18/10/98	09:56:26	1310	-0.16	-0.16	CW
21	18/10/98	09:56:26	1310	-0.16	-0.16	CW
22	18/10/98	09:56:26	1310	-0.16	-0.16	CW
23	18/10/98	09:56:27	1310	-0.16	-0.16	CW
24	18/10/98	09:56:27	1310	-0.16	-0.16	CW
25	18/10/98	09:56:27	1310	-0.16	-0.16	CW
26	18/10/98	09:56:28	1310	-0.16	-0.16	CW
27	18/10/98	09:56:28	1310	-0.16	-0.16	CW
28	18/10/98	09:56:29	1310	-0.16	-0.16	CW

AE

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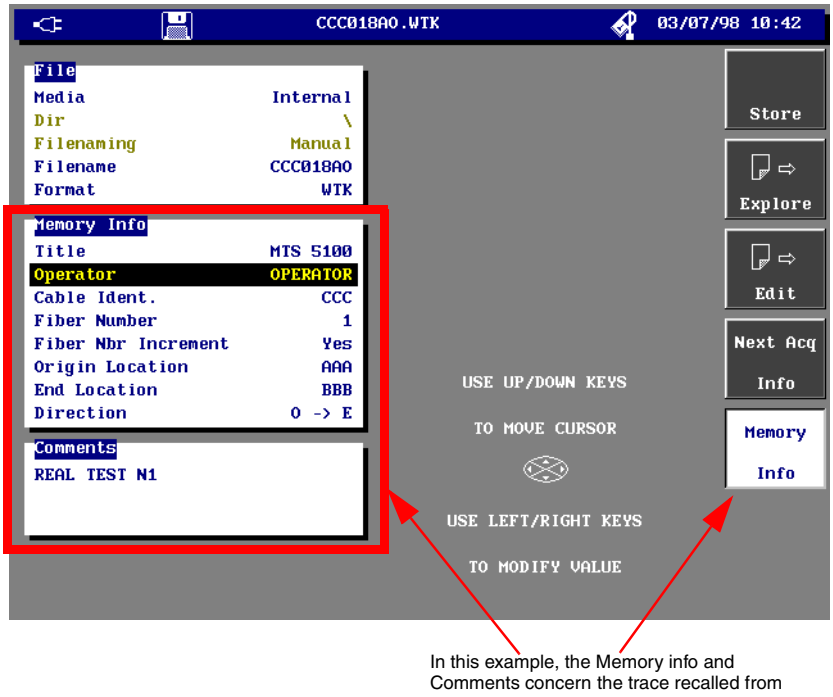
Memory Info and Comments



Memory info menu of the File Manager window

The information displayed in the Memory Info and Comments windows concerns:

- either the acquired trace.
- or the loaded trace if an acquisition has not been made since it was loaded. In this case to read again the data for the current configuration, press the <Next Acq Info> key.

When the Memory Info and Comments concerning the current trace are displayed to call the informations concerning the loaded trace, press the <Memory Info> softkey.

Memory Info

The Memory Info menu allows the operator to add the following identification to the file, using the Edit function.

Title	A title for the measurement of up to 16 characters can be entered to aid identification of the measurement at a later date.
Operator	Enter an operator name.

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Cable Id.	Choose an identification name for the cable. The first three characters of this name are used for the file name when automatic file naming* is selected.
Fiber Number	Select the identification number of the fiber from 0 to 999. This number is used in the file name when automatic file naming is selected.
Auto increment	Selection of auto-increment file name function. The fiber number automatically is incremented at each save operation. This number is also incremented in the file name (auto mode).
Origin Location	Allows a name to be entered for the origin of the fiber.
End Location	Allows a name to be entered for the end of the fiber.
Direction	Selection of the measurement direction: O → E (origin to extremity) or E → O.

Comments

The Comments zone allows the operator to enter with the Edit menu, comments about the file for future reference when the file is reloaded.
This zone contains 3 independent lines of 31 characters.

Manipulating stored data

You can carry out any of the following operations on the data files stored on floppy or internal storage medium: <Load>, <Overlay>, <Copy>, <Delete> or <Rename>.

Note

Only files compatible with the selected module can be loaded : for example, you cannot load an OTS file if an OTDR module is selected.

Explore function

When the media is selected, press the <Explore> key. The display (see page 8-19) presents three windows:

*. See "Filename" on page 8-2

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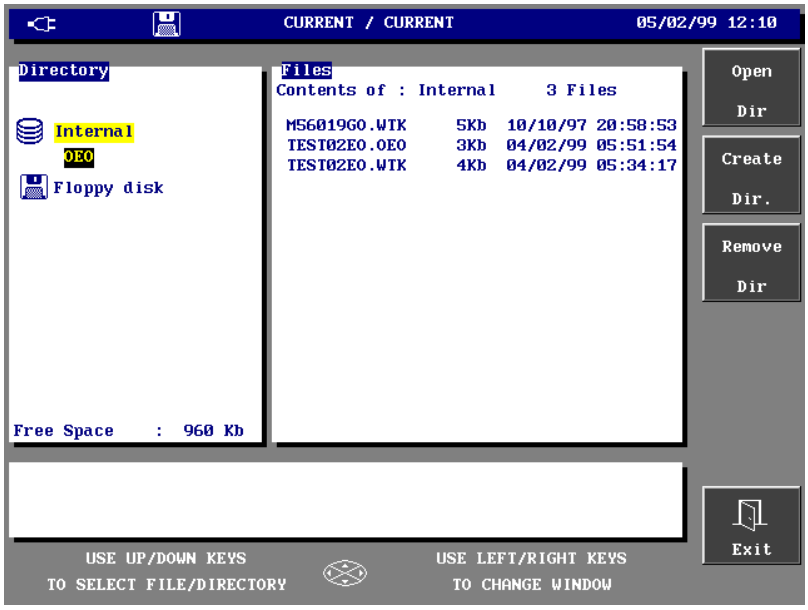

Directory management

Directory window

The left window displays:

- the icons representing the available media RAM or Hard disk and diskette (a double click on these icons gives a direct access at the corresponding media);
- the directories contained in the selected media;
- the free space in the selected media.

When the cursor is in this window softkeys allows:

<Open Dir> to open the selected directory

<Create Dir> to create a new directory in the selected media or directory (seven levels of directory are possible). The Edit menu appears to select the directory name (8 characters max.).

<Remove Dir>to remove the selected directory, on the condition this on is empty.

Files window

The right window displays the number of files contained in the selected media or directory and lists these files.

If the list of files is not completely displayed, arrows on the right of this window shows where are the non-displayed files:

- ↑ : at the beginning of the list

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- ↓ : at the end of the list.

Use the «↑» and «↓» arrow keys to scroll the list.

The directory whose files are listed is highlighted.

Use the arrow keys to move from one window to another or to select a file or a directory in a window.

Bottom window

The bottom window has the name of the selected file. It recalls the following parameters of this file, in order to facilitate the selection:

- For file containing a macro or a logo: the type of file
- For files containing an OTDR trace: its «Memory info» and acquisition parameters on 2 or 3 lines:
  title, operator, cable id, fiber number
  origin, extremity, direction, acquisition date and time
  module, wavelength, pulse, range, average time,
  (comments
- For files containing OTS measurement results
  title, operator, cable id, fiber number
  origin, extremity, direction
  module, serial number, version, measurement date, number of memories

Finding files

To locate a file:

1. Press the **FILE** key, then select the storage medium, Internal or optional Hard disk or optional Floppy disk.
   The name of the selected directory is displayed on the following line (DIR).
2. Press the **<**Explore**>** key.
   The following menu is displayed (if the hard disk has been selected).
3. Select the directory where the file is stored, then press the <Open dir> key.
   The list of files contained in this directory is displayed.
4. Select the required file with the →, then ↑ and ↓ keys.

To have a faster movement of the cursor, if scrolling by using one of the ↑ and ↓ arrow keys, maintaining pressure on this key causes the cursor to skip 3 files at a time.

Selection of several files

It is possible to select several files in order to delete them, print them or copy them on another media.

The selected files are highlighted (yellow with a color screen).

- Move the cursor to the first file as described above, then press the <Select> key. The cursor then moves to the following file.
- If a several consecutive files must be selected, then press the <Select.> key as many times as required.
- If there are several non-consecutive files to be selected, then move the cursor to each file and press the <Select.> key.

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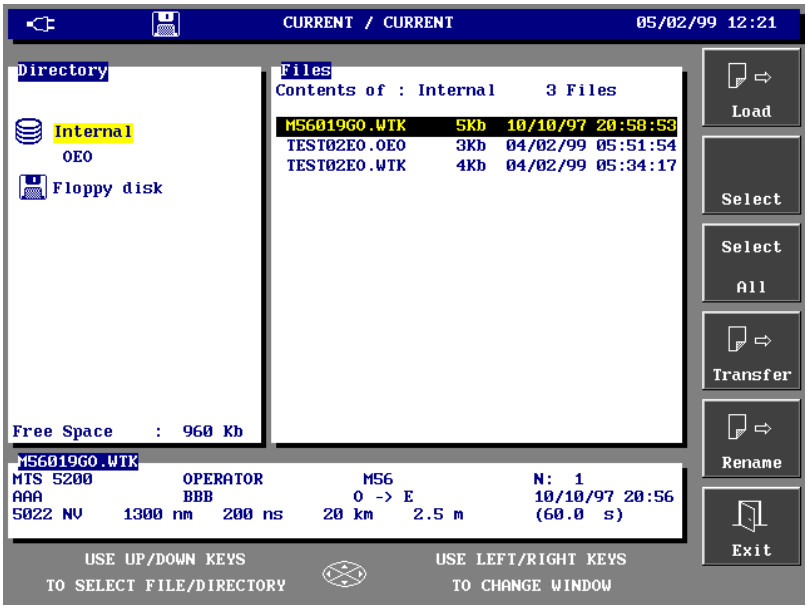
To deselect a file, place the cursor on this file, then press the <Deselect> key.

Selecting all the files in a directory

The <Select all> key selects all the files of the selected directory.
Then, the <Cancel Select.> key allows to deselect all the files.

Note

If there hasn't been any files selected by the <Select.>key, then the file where the cursor is currently placed above is considered as selected.



File explorer

Loading an OTDR trace

When loading a trace, two possibilities are available:

- either load only the trace
- or load together with the trace:
  - the acquisition parameters and the fiber parameters selected when the trace was saved
  - the parameters selected in the file menu (except the media, the directory, the auto increment)

In each case, automatic file naming is inhibited in order to keep the name of the loaded file.

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If the configuration can be recalled it is possible to make an acquisition with the same conditions as those of the recalled trace.

Note

If, during the acquisition of the trace, the OTDR was equipped with a different type of module to the current module, certain configuration parameters will not be able to be set. An error message will notify the user of this problem.

Loading only the trace:

1. Find the file as described above.
2. Press the <Load> then the <Trace> keys.

- If the lock markers icon is displayed, the trace is loaded and a measurement is started with the current locked markers. This allows several traces to be measured using the same markers.
- If the lock markers icon is not displayed, the trace is loaded with its associated measurements.

A floppy disk icon or internal memory icon is displayed in the title bar of the display while the trace is loading. Once the trace has been loaded the MTS^e gives a warning tone and the trace is displayed.

Loading a trace with the configuration:

1. Find the file as described above.
2. Press the <Load> then the <Trace + config.> keys.

- If the lock markers icon is displayed, the trace is loaded with all the parameters defined in "Loading an OTDR trace" on page 8-19 and a measurement is started using the current locked markers.
- If the lock markers icon is not displayed, the trace is loaded with all the parameters defined in "Loading an OTDR trace" on page 8-19 and its associated measurements.

A floppy disk icon or internal memory icon is displayed in the title bar of the display while the trace is loading. Once the trace has been loaded the MTS^e gives a warning tone and the trace is displayed.

Loading an OTS table

1. Find the file as described above.
2. Press the <Load> then the <Table> key.

   A floppy disk icon or internal memory icon is displayed in the title bar of the display while the table is loading. Once the table has been loaded the MTS^e gives a warning tone and the table is displayed.

Deleting a file

Use the procedure given page 8-18 to locate the file(s) to be deleted, then:

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- Either press the <Select> key to select each file you want to delete. Select any of the stored files you want to delete.
- or press the <Select all> key to select all the files in the directory.
- Press the <Transfer> then the <Delete> key.
- Press the <Confirm> key to delete the file or the <Cancel> key to abort the operation.

  A floppy disk icon or internal memory icon is displayed in the title bar of the display while the file(s) is (are) being deleted. Once the files have been deleted the MTS^e gives a warning beep.

Deleting a directory

Note

A directory can only be deleted if it is empty.
So before to start deleting directories you must delete the files they contained.

Use the Find file procedure to locate the directories to be deleted, then:

- Press the <Remove Dir> key.
- Press the <Confirm> key to delete the directory or the <Cancel> key to abort the operation.

  A floppy disk icon or memory icon or hard disk icon is displayed in the title bar of the display according to the media containing the directory.

  Once the directory has been deleted the MTS^e gives a warning beep.

Copying files from one medium to another (if available)

Copies can be made from the floppy disk to the internal memory (or hard disk), or from the internal memory (or hard disk) to the floppy disk.

Copying from floppy disk to internal memory or hard disk (if optional floppy disk present)

- Press the **FILE** key to call the File manager window.
- Select the Floppy disk medium.
- Press the <Explore> key: the directory of the floppy disk is displayed.
- Find the file(s) or directories to be copied (refer to "Finding files" on page 8-18). Press the <Select> key.
- Press the <Transfer> then the <Copy> key.
- Select the media and the directory, then press the <Open Dir> key.
- Press the <Confirm copy> key.
  The file(s) or directories is (are) copied to the internal memory or hard disk.
- the action can be aborted by pressing the <Abort Copy> key.

  While the file(s) is (are) being copied:
  - an internal memory or hard disk icon is displayed in the title bar.
  - the name of the copied file is displayed at the bottom of the screen.

  Once the files have been copied, the MTS^e gives a warning beep.

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Copying from internal memory or hard disk to floppy disk (if option selected)

- Press the **FILE** key to call the File manager window.
- Select the Internal medium or Hard disk.
- Press the **<**Explore**>** key: the corresponding directory is displayed.
- Find the file(s) or directory (ies) to be copied (refer to "Finding files" on page 8-18). Press the **<**Select**>** key.
- Press the <Transfer> then the **<**Copy**>** key.
- Select the Floppy disk media and the directory, then press the <Open Dir> key.
- Press the <Confirm copy> key.
  The file(s) or directories is (are) copied to the floppy disk.
- the action can be aborted by pressing the <Abort Copy> key.

  While the file(s) is (are) being copied:
  - a floppy disk icon is displayed in the title bar.
  - the name of the file being copied is displayed at the bottom of the screen.

  Once the files have been copied, the MTS^e gives a warning beep.

Printing one or more stored traces

- Select printing parameters in the System setup menu (see page 3-12).
- Press the **FILE** key to call the File manager window.
- Select the medium with the files to print: Internal, Hard disk or Floppy disk
- Press the **<**Explore**>** key.
- Find the file(s) to be printed (move the cursor on each file and press the <Select> key).
- Press the <Transfer> then the **<**Print Files**>** key.
  You can then cancel the printing using the <Abort > key.

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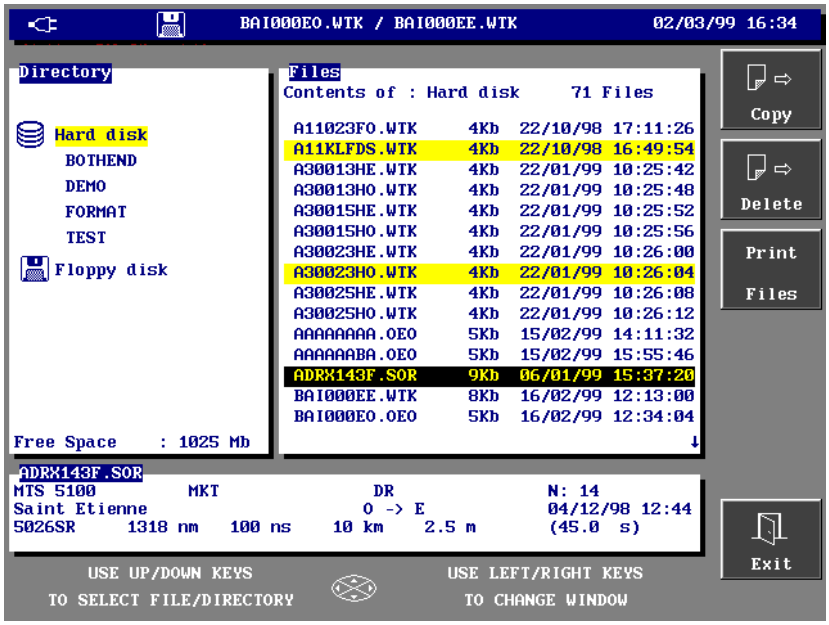

Printing files

Renaming a file

To rename a file:

- Move the cursor on the filename to change as described above (see "Finding files" on page 8-18)
- press the <Rename> key: the Editing menu appears. You can then enter the new name (see "Editing" on page 4-5).

Formatting

The internal RAM memory cannot be formatted.

Formatting a floppy disk (if installed)

Use the following procedure to format a 3 1/2 inch HD floppy disk:

1. Insert a 3 1/2 inch HD floppy disk in the disk drive.
2. Press the **FILE** key.
   The File manager window appears.
3. Move the cursor on the media line and select the floppy disk option in order to display the <Format> key.

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4. Press the <Format> key.
   The <Abort> and <Confirm> keys are displayed to format the disk or abort the operation.
5. Press the <Confirm> key to start formatting the floppy disk.

Note
If there is no disk inserted in the disk drive, when you try to format it MTS^e will display the following error message:

```
(201) Insert a disk
Hit any key to continue.
```

Note
If the disk is write protected MTS^e will display the following error message:

```
(200) disk error
Hit any key to continue.
```

While the disk is formatting, the floppy disk icon is displayed in the window title bar.

No other operation can be carried out while this formatting is in progress. Once the formatting has completed the floppy disk icon is removed and you can continue using MTS^e normally.

Formatting the hard disk (if installed)

Attention
Formatting the hard disk will erase all the files present.

Use the following procedure to format a the hard disk:

1. Press the **FILE** key.
   The File manager window appears.
2. Move the cursor on the media line and select the hard disk option in order to display the <Format> key.
3. Press the <Format> key

   The Format Code window is displayed.
4. Enter the code: 1313 using the left/right arrow key
5. Press the <Valid> key
   The <Abort> and <Confirm> keys are displayed to format the disk or abort the operation.
6. Press the <Confirm> key to start formatting the hard disk.

While the disk is formatting, the hard disk icon is displayed in the window title bar.

No other operation can be carried out while this formatting is in progress. Once the formatting has completed the hard disk icon is removed and you can continue using the MTS^e normally.

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Chapter 9

Remote control

Remote control of the MTS^e uses either the IEEE 488 standard (or international equivalent IEC625-1) or RS232 interface.

English is the default language.

This chapter includes:

- Remote control principles (link to controller, format of commands, tree menus of commands)
- Description of programming commands and queries.

Connection of the MTS^e to a PC

The MTS^e can be remotely controlled via the RS 232-C (type DCE) interface of the controller or by the IEEE option if it is present in the unit.

Connection via the RS232 interface

Connect the serial remote controller to the 9 pin serial connector (RS232 DTE) of the MTS^e.

As PCs are usually configured as DTE, an adaptor (DTE to DCE) may be needed to connect the PC to the MTS^e: see "Serial port (RS 232)" on page 4-10.

Local / Remote command

Send the command *REM to go in remote control mode.
Send the command *LOC to return in local mode.

Selection of the transmission parameters

In the SYSTEM / RS232 menu, if necessary modify the following configuration parameters:

BAUD RATE:	300, 600, 1200, 2400, 4800, 9600, 19200 38400, 57600, 115200
CHAR. LENGTH:	7 or 8 bits
STOP BIT:	1 or 2
PARITY:	Without, Even, Odd
TERMINATOR:	CR, LF, CR LF
PROTOCOL:	XON/XOFF, RTS/CTS, WITHOUT

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Connection via the Ethernet interface

Equipment delivered with the option

- RS232/Ethernet Adaptor plugged into RS232 port.
- Ethernet crossed cable for direct link between PC and MTS^e
- WS-FTP Pro software (ref. 5996/MTS)
- Diskette containing set-up file for WS-FTP Pro.

Link with PC

The link with the PC may be direct or via a network:

1. To establish a direct link, connect the Ethernet ports of the MTS^e and PC by means of the cross cable supplied.
2. To establish a link via the network, ask the network administrator for an IP address and connect the MTS^e on a hub by using a direct cable supplied by the administrator (and not the crossed cable provided for the MTS^e Ethernet option).

What to do with the PC

- Install the software WS-FTP Pro.
- Copy the file «.ini» from the diskette into the directory containing the software WS-FTP Pro by writing over the existing «.ini» file.
- Make sure that the PC has an Ethernet card whose parameters are defined (TCP/IP protocol, IP address and bridge). To access these parameters, in Windows Explorer click on the icons «Work station», then «Configuration panel», then «Network».
- Open the software WS-FTP pro.
- If necessary, change the address of the MTS^e in «Host Name».

Configuration of MTS^e

- Start the MTS^e and press the key <Config. System>.
- Select the interface E/S: FTP/Ethernet. To do this, if the interface selected is RS232, press the left arrow <- to avoid passing via the FTP/PPP position, for which you would have to wait for the protocol change.
- Configure the Ethernet interface: IP address, IP mask, IP bridge.

Note The IP address is in the following form: xxx.xxx.xxx.xxx
If one of the numbers in this address has only one or two figures, enter only this (or these) figure(s). Do not add a zero, otherwise the link will not be established.

Note To check that the connection has been made correctly, without using the software WS-FTP Pro, click on Start, then on Execute..., and choose: «ping» followed by the IP address of the MTS^e.

Connection via a modem

1. Connect the modem to the MTS^e:

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- either via the RS232 connector. In this case, in the menu System set-up menu, on the Remote Access line select the option TCP/PPP.
- or via the Ethernet connector (if the option is present). In this case, in the menu System set-up menu, on the Remote Access line select the option TCP/ETH.

2. Press on the <Init Modem> key: the modem connected to the MTS^e is initialized. You are ready to transfer data.

Connection via the IEEE interface

(optional, for MTS 5200^e mainframe only: ref 5200/IEEE)

Connect the controller to the IEEE port of the MTS^e.

The primary address of the MTS^e should be selected from 0 to 30 in the system setup menu. Usually the address 0 is reserved for the controller.

Description of commands and queries

Command errors

Remote control errors are saved in the event status register.

- a «command error» (bit 5 of the register) is detected:
  - if the command is not in the programming dictionary.
  - if the parameters are out of range or incorrect.
- an «execution error» (bit 4 of the register) is detected: if the instrument cannot execute the command in the given context; examples: if modification of an acquisition parameter while measurement is in process, etc.

To know the command error, either read the Standard Event Register by <*ESR?> or enable the selected bit(s) of the Standard Event Enable Register by <*ESE> to be warned by a SRQ. See "Status structure Registers" on page 9-6.

Command Format

Remote control commands conform to the IEEE 488 (IEC 625-2) standard. They have a hierarchical structure with a top level (root) and one or more lower-levels (nodes).

Commands are performed by stringing together nodes.

Example:

ACQ:PULS P5NS

- ACQ is the root
- :PULS is the second level node
- P5NS is the parameter of the second level node.

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Command Syntax

- Commands include upper and lowercase characters

  - only uppercase characters are required,
  - lower case characters can be removed to abbreviate the commands.
- Successive nodes should be separated by a colon (:)
- A space should separate the last level node from any possible associated parameter. If there are several parameters, a comma should separate them.
- Examples of command:

  - complete: ACQUISITION:LASER L850
  - abbreviated: ACQ:LAS L850

Abbreviation of command header

Generally, when the header has more than four characters, the following rules are adopted:

- The first four characters of the header are used, except if the fourth is a vowel. In the latter case the vowel is dropped and only the first three characters are necessary.

  Example: ACQ for ACQUISITION
  MEAS for MEASUREMENT
- If the command is made from several words, the first letter of each word is used, except for the last one (three or four first characters).

  Example: MSL for Measurement Slope
  DSPL for Display Splice

Linking commands

Successive commands should be separated by a semicolon(;).

Parameters

There are several parameter types:

- Numerical: decimal, signed and scientific numbers

  Examples: 245, 687E2, -1.48E3, .426, 1.100E-4
- Key words. Examples: OFF, ON, YES, NO
- String of ASCII characters which should be enclosed within quotes (") or (')

  Example: «TRACE TITLE»

Queries

The commands generally have an associated query.

- Most of the queries have no parameters. They are terminated by? They are not specified in the following dictionary of the commands.

  Examples:

  SYST:PRIN? request the printer mode selected

  IDEN:OPER? request the identification of the operator

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- For queries requiring parameters the "?" is between the last node and the first parameter. They are given in the following command dictionary. A space is required just after the "?".

  Examples:

FIB:K? L1310	request the K coefficient for the wavelength 1310 nm
ONOT? 24	request the note entered in the table for event number 24

Common part commands

Remote Local mode (RS232 commands only)

*REM — Request to go to the remote mode.

*LOC — Request to return to local mode.

Identification and option queries

*IDN? — MTS^e request the MTS^e identification.

MTS^e Response: Acterna, MTS5100, n, X.YZ
with: n serial number
X.YZ software version

*OPT? — Request options available on the MTS^e

Reset commands

*RST — Reset the SLGX1 LP to a predefined configuration (default state)

SRQ commands (IEEE interface only)

The IEEE.2 commands recognized by the MTS^e are the following:

*STB? — Device status register read request

Device Response: NR1 number from 0 to 255.
Response to serial poll with bit 6: MSS.

*SRE — Device service request enable

*SRE is followed by a number from 0 to 63 or 128 to 191.
Action: The device modifies the bits in its service request enabling register. This instruction is associated with *SRE?.

*ESR? — Device event register contents query

Device Response: NR1 number from 0 to 255.
All events are cleared and the register is reset.

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*ESE — Device event bit enable

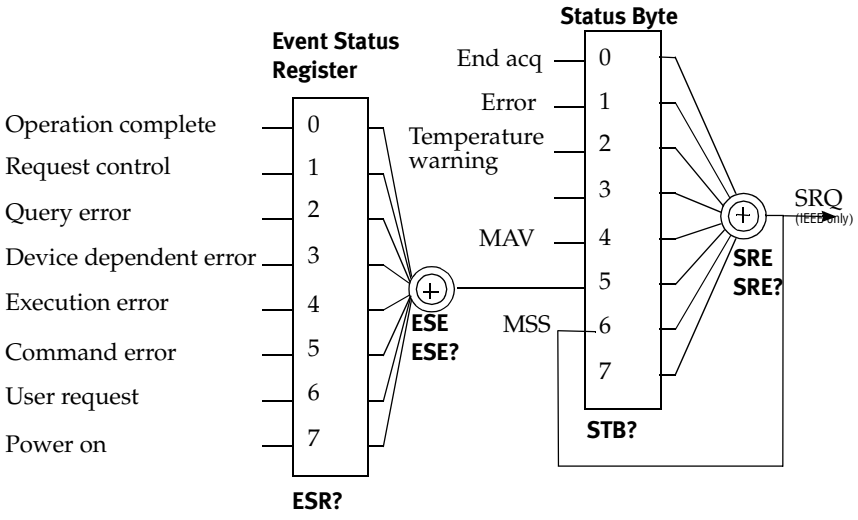
* ESE is followed by a number (0 to 255)
Action: Enabling register modified and ESB bit updated. This instruction is associated with *ESE?

*CLS — Clear status registers

- clear standard event register in RS 232
- clear standard event register and device status register in IEEE.

Action: The device resets the status word register. If this command is the first in a message, the output queue is reset. If not, the queue is initialized on reception of the next message.

Status structure Registers



- Bit 0 of STB — at 1 at the end of the measurement; at 0 at the next acquisition or if STATUS:ACQ? is read
- Bit 1 of STB — at 1 if a warning is displayed; at 0 when a message is read by STATUS:ERROR?
- Bit 2 — warning: excessive temperature in a module
- Bit 4 of STB — Message Available (MAV)
- Bit 6 of STB — Master Summary Status (MSS)

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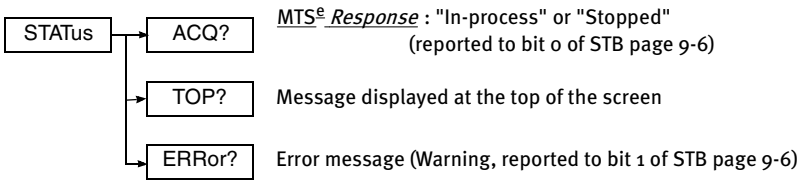
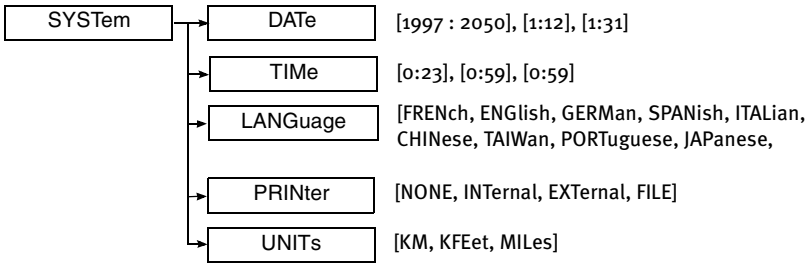
Status commands


STATus
ACQ?
MTS^e *Response* : "In-process" or "Stopped"
(reported to bit 0 of STB page 9-6)
TOP?
Message displayed at the top of the screen
ERRor?
Error message (Warning, reported to bit 1 of STB page 9-6)

They query results from a previous command. A result field indicates if the command succeeded and an error code in the case of failure.

System setup commands

Format des commandes



Description des fonctions

DATe	update the MTS^e clock (year, month, day of the month).
TIMe	set the time (minutes, hours, seconds)
LANGuage	select the language used in the menus (if a VGA monitor is used)
UNITs	select the length unit: kilometers, kfeet or miles.

Example of command

SYST:DAT 2000,1,31

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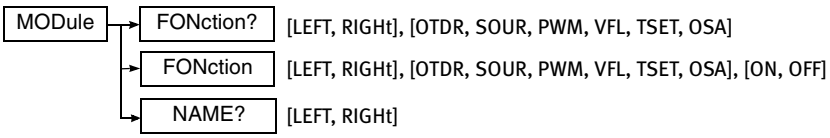
Commands relative to the module and the function

Format des commandes



Description des fonctions

- Module functions
  OTDR Reflectometer
  SOUR Source
  PWM Power meter
  VFL Visual fault locator
  TSET Talk set
  OSA Optical Spectrum Analyser (WDM)
- Module on or off
  ON Module On
  OFF Module Off
- Position of the module in the instrument
  LEFT, RIGHt: position of the module in the instrument
  (seen from the rear of the MTS[e]).

Commands relative to the keys

Format des commandes

KEY [STARt, FILE, RESult, SETup, HELP, UP, DOWN, LEFT, RIGHt, HOMe, PREView, SK1,

Description des fonctions

STARt Starts /stops an acquisition.

FILE Calls up the file storage and management menu.

RESult Calls up the results screen for all measurement analysis operations.

SETup Calls up the set-up menus.

HELP Calls up the on-line help pages.

UP, DOWN, LEFT, RIGHt: directional arrows ↑ , ↓ , ← , →.

HOMe re-displays the trace with no shift or zoom.

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PREView Begins the waveform acquisition in real time without averaging the results. The unit either can be stopped remotely during the real time acquisition or will stop automatically after 10 minutes.

SK1, …SK6 Softkey 1 to 6 (from top to bottom of the display).

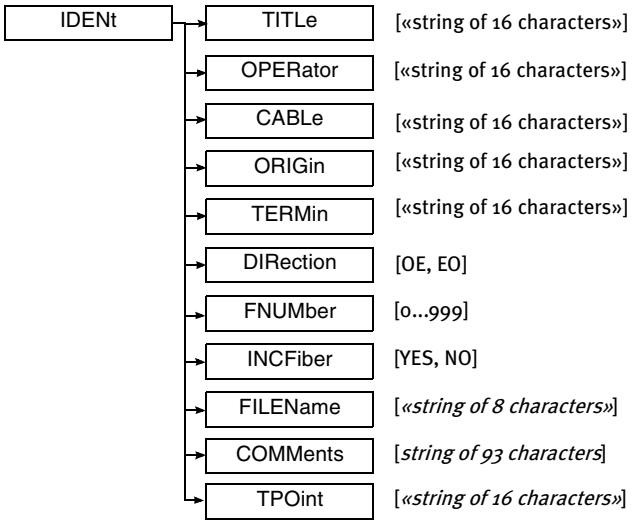
BEGinacq Begins the waveform acquisition and averages waveform results during the acquisition period. The unit either accepts a number of seconds for the acquisition time or can be stopped remotely during averaging.

HALTacq Stops an acquisition.

Identification commands for a previous measurement

This information concerns the loaded trace («memory info» of the file menu).

Format des commandes



Description des fonctions

TITLe Title for the measurement.

OPERator Operator name.

CABLe Identification name for the cable. The first three characters of this name are used for the file name when automatic file naming is selected.

ORIGin Name for the origin of the fiber.

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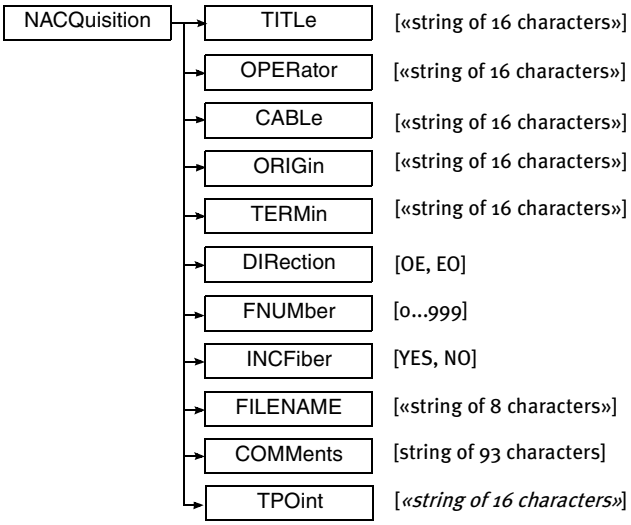
TERMin	Name for the end of the fiber.
DIRection	Measurement direction: O → E (origin to extremity) or E → O.
FNUMber	Identification number of the fiber from 0 to 999. This number is used in the file name when automatic file naming is selected.
INCFiber	Auto-increment file name function. The fiber number is automatically incremented at each save operation. This number is also incremented in the file name (auto mode).
FILEName	Filename.
COMMents	comments about the file for future reference when the file is reloaded (3 independent lines of 31 characters).
TPOint	Test point (WDM module only).

Next measurement identification commands

This information concerns the acquired trace («next acq. info.» of the file menu).

Format des commandes



Description des fonctions

Identical to Identification commands for a previous measurement.

Remarks in table

(Result window display chosen via the Test Setup menu).

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Format des commandes

ONOTes [1:100], [string of 41characters]

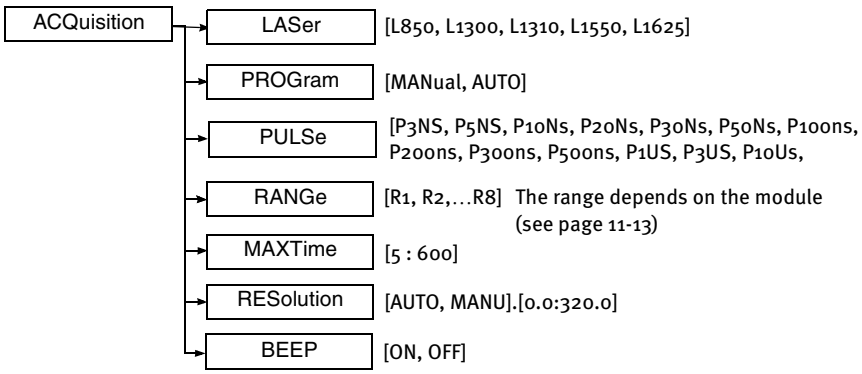
Description des fonctions

Note of up to 41 characters associated with an event. For each wavelength, a maximum of 16 notes are possible.

Command relative to the OTDR module

Acquisition commands

Format des commandes



Description des fonctions

LASer	Sets the laser source to the appropriate wavelength supported by the optics subsystem of the unit (depending on the module installed).
PULSe	Sets the pulse width to a value supported by the optics subsystem of the unit (from 3 ns to 20 µs depending on the modules).
RANGe	Sets the distance range to a value supported by the optics subsystem of the unit (depending on the modules).
MAXTime	Sets the acquisition period used for averaged acquisitions (from 5 s. to 10 mn). Note: a real time acquisition will stop after 10 minutes.
RESolution	Set the resolution to a value supported by the optics subsystem of the unit (from 8 cm to 320 m depending on the module):

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AUTO: The MTS^e will choose the appropriate resolution. The second parameter is necessary but not significant.
MANU: the resolution must be given in the second parameter. If the selected value is less than the min. possible value, then the min. possible value will be selected.

BEEP — Choice of whether or not the end of an acquisition is signalled by an audible beep.

PROgram — Autoconfiguration command for the next acquisition
MANual: the MTS^e will choose the acquisition range, pulse, resolution and acquisition time specified by the operator using the above commands.
AUTO: the auto-config function is enabled. The MTS^e will choose the appropriate acquisition range, pulse and resolution in relation to the acquisition time specified by ACQ:MAXTime for the fiber under test. As soon as these acquisition parameters have been chosen, a «final acquisition» is launched using these chosen parameters for the specified acquisition time. An automatic measurement is made at the end of the final acquisition.

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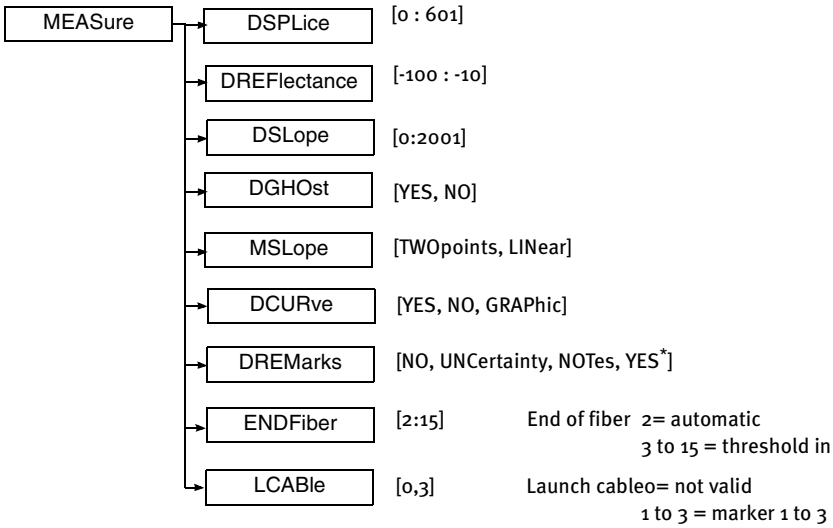
Result commands

Format des commandes



*. NOTes and YES are equivalent

Description des fonctions

DSPLice — Splice threshold between 0 and 601 in hundredth of dB:
0: all splices displayed;
601: no splice displayed
Factory default value: *ALL*

DREFlectance — Reflectance threshold in dB, between -11 and -99.
- 100: all reflectances displayed.
- 10: no reflectances displayed.
Factory default value: *ALL*

DSLope — Slope threshold in thousandth of dB/km between 0 and 2001:
0: every slope displayed
001: no slope displayed
100: slopes > 0.1 dB displayed
Factory default value: >0.10 dB/km

DGHOst — Choose from yes or no to display ghost information. If ghosts are displayed: the reflection icon is shown dotted in the result table, the reflection value is shown between parentheses on the trace;

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	e.g. "(R:-50dB)". Factory default value: yes. Ghosts are only detected during an automatic measurement.
MSLope	Slope measurement methods: least squares (LSA) or 2-point loss. Factory default value: LSA
DCURve	Measurements displayed on trace: No: the trace only YES: the trace with results and markers GRAPhic: the trace with markers only. Factory default value: YES
DREMarks	display of notes in the table NO: no additional display YES and NOTes: display notes entered by the user UNCertainty: display notes entered by the user and confidence indicators for the result measurements. Factory default value: No
ENDFiber	Fiber end threshold from 2 to 15. 2= automatic (factory default option) 3 to 15 = threshold in dB In most cases the AUTO option is advised.
LCABle	Choose to display in the event table, the results referenced to the launch cable. - 0: all the results are displayed and the reference is the origin of the fiber. - 1, 2 or 3: results are referenced from the marker 1, 2 or 3 selected. This marker is considered as the «end of launch cable» and is the reference for loss and distance measurements. Factory default value: No.

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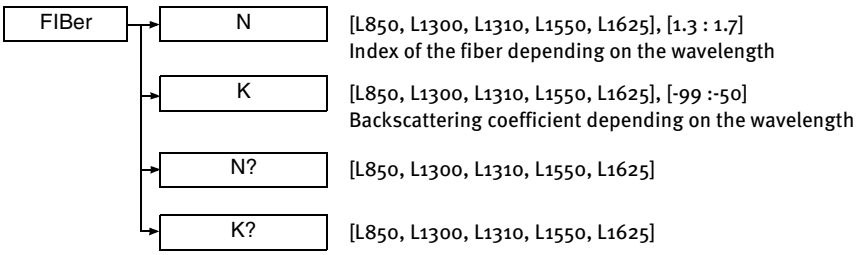
Fiber commands

Format des commandes


FIBer
N
[L850, L1300, L1310, L1550, L1625], [1.3 : 1.7]
Index of the fiber depending on the wavelength
K
[L850, L1300, L1310, L1550, L1625], [-99 :-50]
Backscattering coefficient depending on the wavelength
N?
[L850, L1300, L1310, L1550, L1625]
K?
[L850, L1300, L1310, L1550, L1625]

Description des fonctions

N Sets the group index of refraction of the total fiber under test from 1.30000 to 1.70000.

K Backscatter coefficient from -99 dB to -50 dB in 0.1 dB steps. Modification of K modifies the reflectance and ORL measurements.

N and K depends on the wavelength: 850 nm MM, 1300 nm MM, 1310 nm SM, 1550 nm SM and 1625 nm SM.

N? Reads the group index of the fiber, for the given wavelength.

K? Reads the backscatter coefficient of the fiber, for the given wavelength.

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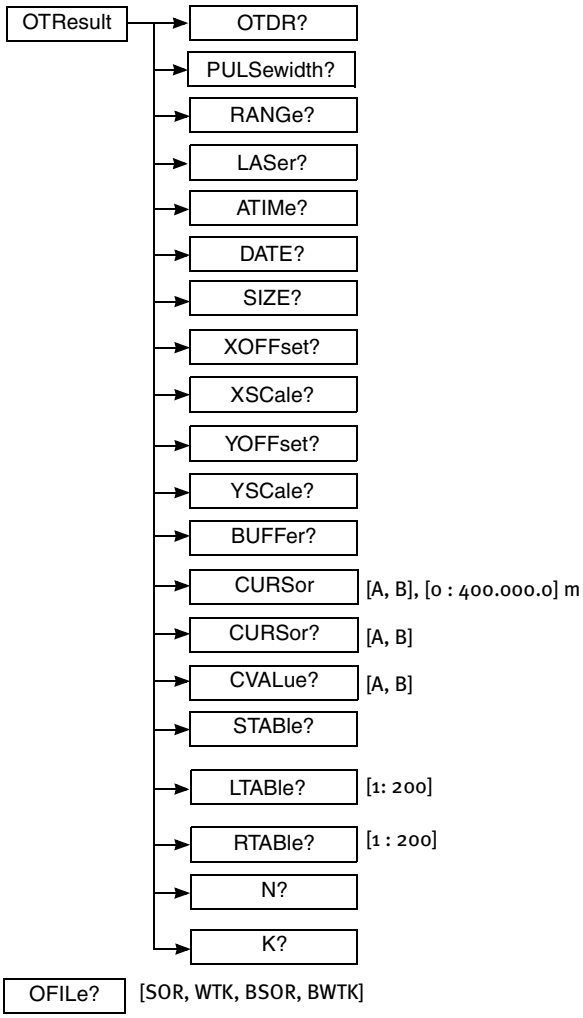
Reading of OTDR results commands

Format des commandes



Description des fonctions

These commands retrieve test results in the Bellcore GR-196-CORE Issue 1, 1995 Standard OTDR Record (SOR) format.

OTDR? Returns the MTS[e] type.

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PULSewidth? Returns the pulsewidth

RANGe? Returns the range

LASer? Returns the wavelength

ATIMe? Returns the acquisition time

DATE? Returns the date

SIZE? Returns the number of points (size of the trace).

XOFFset? Returns the X axis offset

XSCale? Returns the X axis scale

YOFFSet Returns the Y-axis offset

YSCale? Returns the Y axis scale

BUFFer? Returns the buffer storing the trace
(see next section for more details).

CURSor Choice of cursor A or B.

CURSor? Returns the A or B cursor position.

CVALue? Returns the result at the cursor A or B position (value in dB).

STABle? Returns the number of lines in the table

LTABle? Returns the content of a line in the table
Response given as a string. Error message if the line does not exist.
Example of response to the command:
OTResult:LTABle? 30

Splice	27953.35	0.015		0.274	3257.2	7.670
Type of event	distance	attenuation	reflectance (if available)	slope before event	section length	Total Loss

RTABle Returns the content of a user note in the table (number of the line between 1 and 200).
Response given as a string. Error message if the line does not exist.

N? Returns the group index used for the fiber trace.

K? Returns the backscatter coefficient used for the fiber trace.

OFILe? Returns the current trace as a file (analog to files saved using the **FILE** menu) in either a Bellcore or Wavetek file format:
SOR: Bellcore
WTK: Wavetek
BSOR: Bellcore with the size of the file in front of the results
BWTK: Wavetek with the size of the file in front of the results

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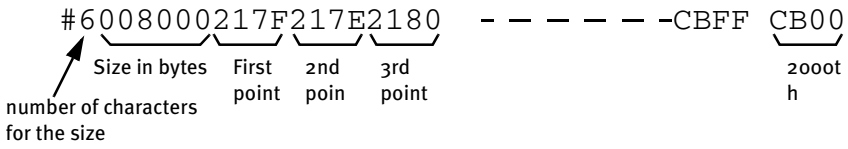
Reading the buffer storing the trace

The current curve is stored in a buffer.
Capacity of this buffer: 4 x number of points.

Each point is coded using four ASCII characters on 16 bits.

Command used to read the buffer: **OTResult:BUFFer?**

Example of response for a buffer of 2000 points:



In this example, for the first point, the y value is 217F in signed hexadecimal. To know the value in dB process as follows:

- convert 217F in signed decimal: 8575
- use the commands given below to know the coefficients A and B
- value in dB with the given examples:
  A*y + B = (-0.001470 x 8575) + 12.640910 = 0.036 dB

In this example, for the last point, the y value is CB00 in signed hexadecimal. Thus:

- CB00 in signed decimal = -13568
- the value in dB is:
  A*y + B = [-0.001470 x (-13568)] + 12.640910 = 32,586 dB

Number of points in the buffer?
OTRESult:SIZE?
Example of response: 32000

Abscissa of the first point in second?
OTRESul:XOFFset?
Example of response: 0.000000
To convert this result from second to distance, report to "Conversion from delay to distance" on page 9-19.

Time between 2 points?
OTRESul:XSCale?
Example of response: 6.250000e-09
To convert this result from second to distance, report to "Conversion from delay to distance" on page 9-19.

Coeff B of the function A*y + B?
OTRESult:YOFFset?
Example of response: 12.640910

Coeff A of the function A*y + B?
OTRESult:YSCale?
Example of response: -0.001470

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Conversion from delay to distance

To convert the result from second to meter, use the following formula:

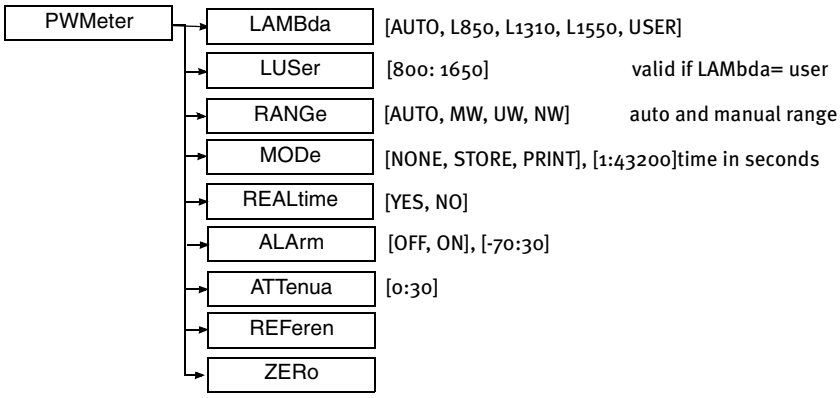
$$D_{(meters)} = \frac{c \times t}{2 \times n} \sim 10^8 \times time_{(s)}$$

with: c = speed of light in vacuum (2.99792458 m/s)
n = refractive index of the fiber
t = time (expressed in second) to convert in distance

Commands relative to the OTS modules

Power meter set-up

Format des commandes



Description des fonctions

LAMbda — Wavelength for the measurement

LUser — Selection of any wavelength value between 800 nm to 1650 nm (if LAMbda = USER)

RANGe — Measurement range of the power meter: Auto, mW, µW or nW.

MODe — NONE: no automatic storage, neither automatic printing of the results.

STORE: automatic storage of the results in a file at the time interval selected in seconds in the second parameter.

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	PRINT: automatic printing of the results on the printer connected to the MTS^e at the time interval selected in seconds in the second parameter.
REALtime	Choice of the real time or averaging mode. When this mode has not be selected the power meter is, by default, in averaging mode.
ALArm	Selection of the required alarm threshold (-70 to +30 dBm).
ATTen	Entry of the value (0 to 30 db) of an external attenuator, if one is being used.
REFeren	Select the currently displayed value as a reference value to compare to other measured results.
ZERo	Adjust the zero setting of the power meter when a blanking cap is fitted to the power meter optical input.

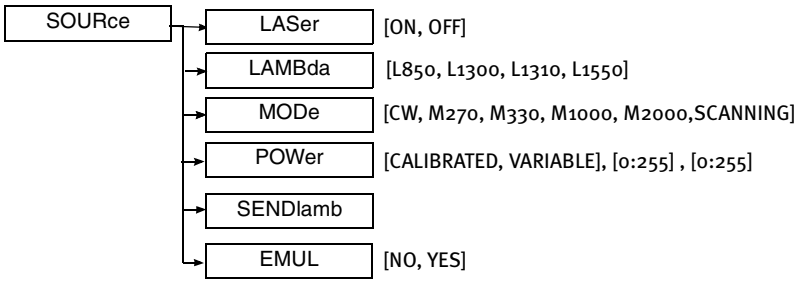
Power meter reference query

Format des commandes

Response: reference value for the Wavelength selected.

Laser source set-up

Format des commandes



Description des fonctions

LASer	ON: validates the emission from the laser or LED. OFF: stops the emission from the laser or LED
LAMBda	Choice of wavelength (according to configuration of module): 1310 or 1550 nm for LASER source 850 or 1300 nm for LED source

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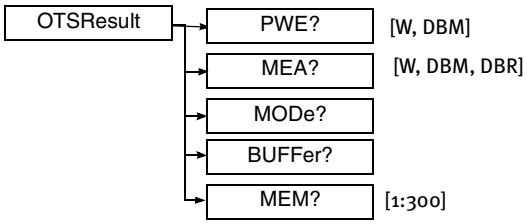
MODe	Transmission mode of signal emitted: CW: continuous power M270, M330, M1000, M2000: power modulated to selected frequency (270 Hz, 330 Hz, 1 kHz, 2 kHz) SCANNING: sources are alternated at regular intervals.
POWer	Transmitting power of laser source: CALIBRATED: power calibrated to 1 mW (0 dBm). VARIABLE: variable power from 0 to -10 dBm (if continuous mode only). Second parameter: rough setting from 0 to 255. Third parameter: fine setting from 0 to 255.
SENDlamb	If continuous mode was chosen, this commands the sending of a signal to the radiometer which switches it to the same wavelength as the source.
EMUL	Used to emulate the operation of the OLS sources of the WWG family.

Reading of OTS results

Format des commandes



Reply to command

PWE?	Power emitted by source in W or dBm.
MEA?	Power measured by radiometer in W, dBm or dBr.
MODe?	Reception mode: continuous (CW) or modulated to following frequencies: 270 Hz, 330 Hz, 1 kHz or 2 kHz (M270, M330, M1000, M2000).
BUFFer?	Result of measurement stored by Auto store mode. Response on a line for each measurement: **Date Hour, Lambda, Result (dBm), result (dBr), Received mode** Example of response: **22/12/98 09:42:28, 1310 nm, -10,03 dBm, 0,00 dBr, Cw** Only the parts of the buffer containing measurement results are

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read. For example, if ten measurements have been conducted, ten lines with the above format will be sent.

MEM? Reading of one of 300 measurement results which were able to be stored in memory. This result is given on one line in the form:
Date Hour, Lambda, Result (dBm), Res. (dBr), Ref (dBm), Received mode

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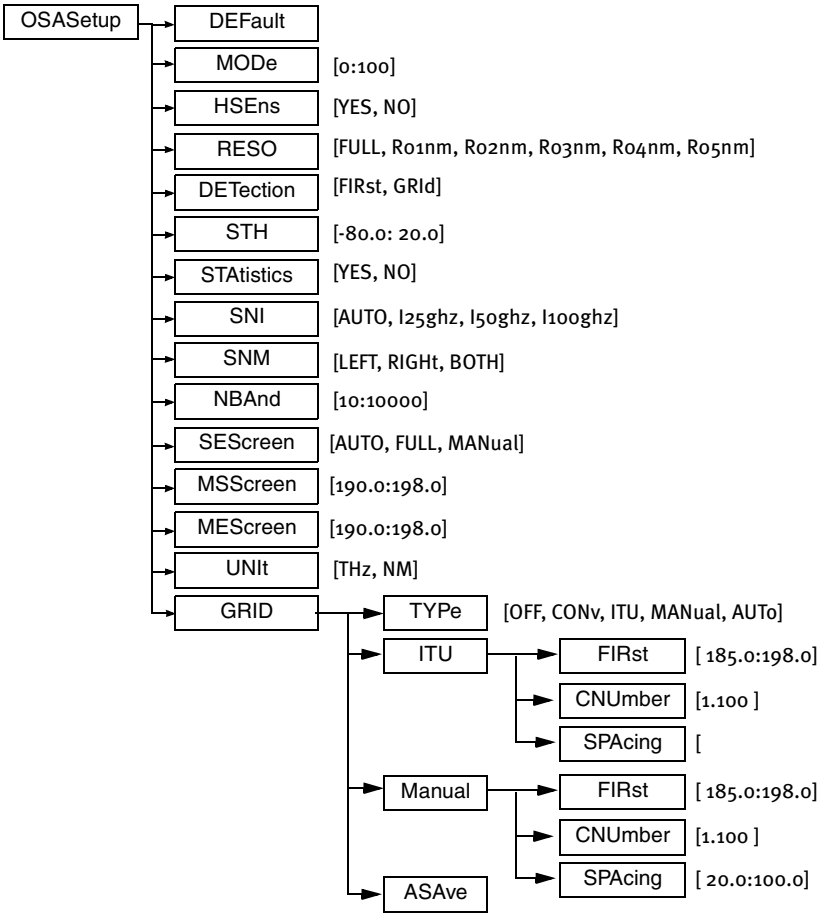
Commands relative to the WDM module

Configuration OSA

Format des commandes



Description des fonctions

DEFault Configuration choice by default.

MODe The number of acquisitions used for the statistics
1 = only one acquisition

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	2 to 100: the number of acquisition 0= continuous acquisition
HSEns	YES = commutation of High sensitivity saving.
RESO	Filter resolution. FULL: maximum filter resolution (<0,1 nm) R01, R02, R03, R04, R05 = 0,1 / 0,2 / 0,3 / 0,4 or 0,5 nm.
DETection	Detection of channels: FIRst: on the first acquisition. GRId: according to the manual grid.
STH	Signal presence threshold (-80 to 20 dBm) on the measurement table. Threshold Auto = - 80.0.
STAtistics	YES / NO: to do / not to do statistics.
SNI	Space with the peak, from the reference point for the noise: AUTO I25ghz, I50ghz, I100ghz: to 25, 50 or 100 GHz of the peak.
SNM	Side of the peak from where the reference point is taken for the noise. LEFT, RIGHt: left, right. BOTH: left and right.
NBAnd	Width of the noise bandwidth used in the Signal/Noise, from 10 pm to 10 000 pm. Default value 100 pm.
SEScreen	Start and end of screen display: AUTO: Automatic detection of start and end of display. FULL: Start of display at 1525 nm; End of display at 1570 nm. MANual: choice of the following commands
MSScreen	Choose the start of the display (from 190.0 THz to 198.0 THz).
MESceen	Choose the end of the display (from 190.0 THz to 198.0 THz).
UNIt	Unit chosen for the horizontal axis.
GRID	Choose the type of reference grid: ITU FIRst first channel in THz MAN number of channel SPA spacing between channel in tenth of GHz MAN FIRst first channel in THz MAN number of channel SPA spacing between channel in tenth of GHz
ASAve	Save the locations of the channels to set the automatic grid on them.

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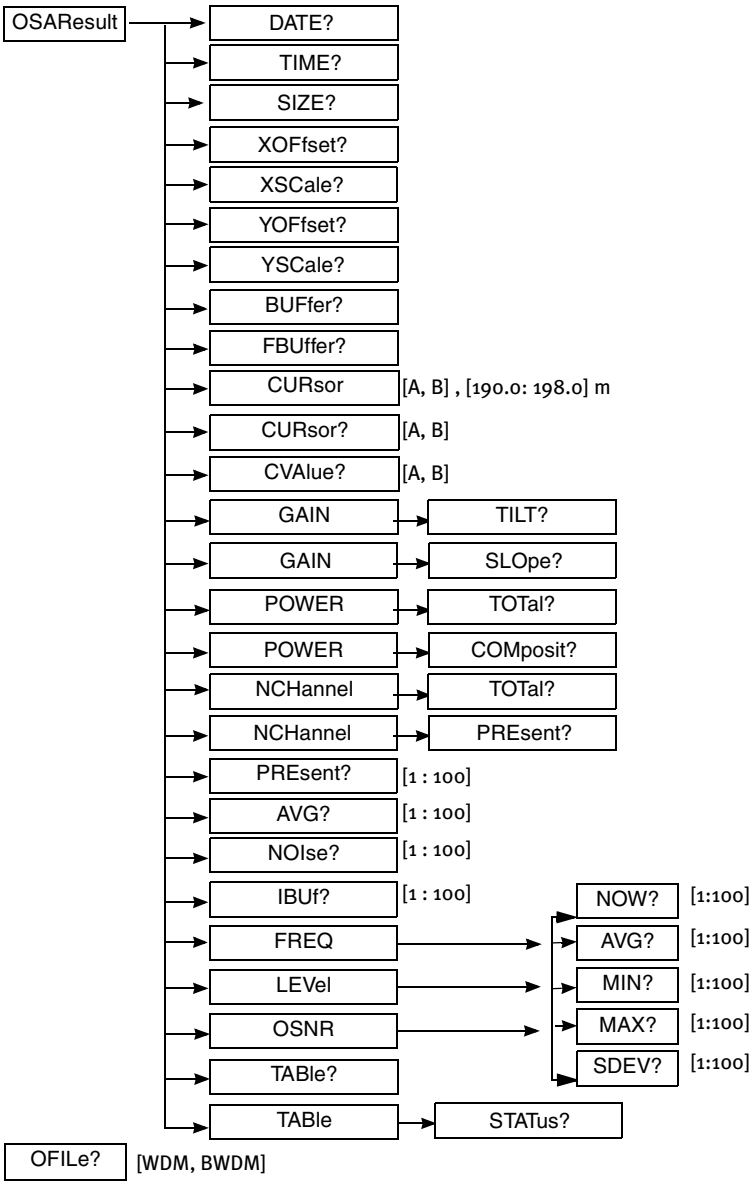
Reading of OSA results

Format des commandes



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Description des fonctions

DATE	Acquisition date
TIME	Acquisition time
SIZE?	Number of points on the curve*
XOFfset?	First point of Abscissa (in THz)[1]
XSCale?	Space X between two points (in THz)[1]
YOFfSet	Y axis shift - Coefficient B of «val dB = A*y + B» [1]
YSCale?	Y axis scale - Coefficient A of «val dB = A*y + B» [1]
BUFfer?	Reading of the memory containing the curve in ASCII[1].
FBUffer?	Reading of the memory containing the curve in binary.
CURsor	A or B cursor position
CURsor?	A or B cursor position?
CVAlue?	Intersection level (in dBm) point of the A or B cursor and the curve?
GAIN:TILT?	Gain tilt between the cursors in dB?
GAIN:SLOpe?	Gain slope in dB /THz?
POWER:TOTal?	Power total in dBm?
POWER:COMpos?	Composite power?
NCHannel:TOTal?	Total number of detected channels at first acquisition?
NCHannel:PREsent?	Total number of detected channels at last acquisition?

Commands relative to a channel for which the order number is indicated:

PREsent?	Present channel?
AVG?	Number of acquisitions on the channel to calculate the min., max., and average value?
NOIse?	Channel noise level?
IBUf?	Channel position in the buffer?
FREQ:NOW?	Last acquisition channel frequency?
FREQ:AVG	Average channel frequency?
FREQ:MIN?	Minimum channel frequency?
FREQ:MAX?	Maximum channel frequency?
FREQ:SDEV?	Channel standard deviation frequency?

*. Refer to the "Reading the buffer storing the trace" on page 9-18.

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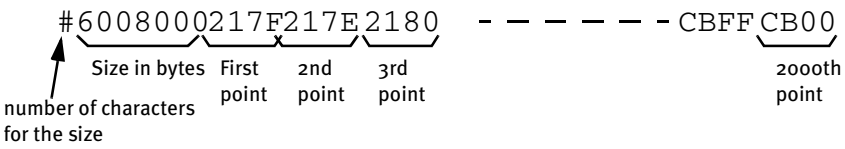
LEVEL:NOW?	Last acquisition channel level?
LEVEL:AVG	Average channel level?
LEVEL:MIN?	Minimum channel level?
LEVEL:MAX?	Maximum channel level?
LEVEL:SDEV?	Channel level standard deviation?
OSNR:NOW?	Signal/Noise of the channel during the last acquisition?
OSNR:AVG	Signal/Average noise for the channel?
OSNR:MIN?	Signal/Min. noise for the channel?
OSNR:MAX?	Signal/Max. noise for the channel?
OSNR:SDEV?	Signal/Noise standard deviation for the channel?
OFILe?	Returns the current results in a file. Acterna file format: WDM or BWDM. The BWDM file is the same as the WDM one but the size of the file is given in front of the response.
TABle?	Returns the current table in a file in ASCII format.
TABle:STATus	Returns "UPDATED" if a new table can be read. Otherwise returns "NOT UPDATED".

Reading the buffer storing the trace

The current curve is stored in a buffer.
Capacity of this buffer: 4 x number of points.
Each point is coded using four ASCII characters on 16 bits.
Command used to read the buffer: **`OTResult:BUFFer?`**
Example of response for a buffer of 2000 points:



In this example, for the first point, the y value is 217F in signed hexadecimal. To know the value in dB process as follows:

- convert 217F in signed decimal: 8575
- use the commands given below to know the coefficients A and B
- value in dB with the given examples:
  A*y + B =(-2.939746e-03 x 8575) + 34.590000= 9.382 dB

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In this example, for the last point, the y value is CB00 in signed hexadecimal. Thus:

- CB00 in signed decimal = -13568
- the value in dB is:
  A*y + B = [-2.939746e-03 x (-13568)] + 34.590000 =- 13533.412 dB

Number of points in the buffer?
OSARESult:SIZE?
Example of response: 32000

Abscissa of the first point in THz?
OSARESul:XOFFset?
Example of response: 196.585464

Interval between 2 points in THz?
OSARESul:XSCale?
Example of response: 7.566895e-04

Coeff B of the function A*y + B?
OSARESult:YOFFset?
Example of response: 34.590000

Coeff A of the function A*y + B?
OSARESult:YSCale?
Example of response: -2.939746e-03

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Chapter

Maintenance 10

This section details the following operations for the MTS^e:

- ❏ Maintenance procedure
- ❏ Conditions of guarantee
- ❏ Cleaning

For software updates or to find our Acterna representatives and technical support offices around the world please visit our web site: www.acterna.com

Maintenance procedure

Maintenance work on this instrument can only be undertaken by qualified personnel using suitable equipment.

In the majority of cases, it is advisable to contact the nearest Acterna Service Centre, which will undertake the appropriate troubleshooting and repair work.

The performance and technical complexity of the MTS^e class this instrument in a new generation of equipment, for which Wavetek has defined a maintenance policy based on the modular standard replacement principle.

In implementation of this policy, we have set up powerful card troubleshooting test resources in our factories and a rapid dispatch system operating between our factories and branches.

Only by this procedure can the high quality of the instrument continue to be ensured after repair work. This procedure also has the advantage of reducing repair cost and time.

In order to ensure maximum quality and efficiency, we strongly recommend adoption of the following maintenance procedure in the event of a fault or failure:

- Verify that the instrument is plugged in.
- Verify the connections of any peripheral equipment to the MTS^e.

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- If a fault is detected, or if a doubt exists, it is advisable to contact the nearest Wavetek Service Centre which will undertake the appropriate repair work.

Returning an instrument

When returning an instrument, please indicate the following minimum information:

- The type and serial number of the instrument
- A description of the fault found with the instrument.

The returned instrument will then be repaired and calibrated.

Guarantee conditions

Any exchange of boards or sub-assemblies during the instrument's guarantee period is carried out at the expense of Wavetek. For any work carried out on a board or sub-assembly other than by Wavetek Service Centers, the cost of the replacement board or sub-assembly will be invoiced.

Cleaning

Cleaning the front and rear panels and the covers

The front and rear panels, as well as the covers, can become tarnished with use. To clean them, use soapy water.

Do not use products with a petroleum spirit, trichloroethylene, benzene or alcohol base, as they attack the printed markings.

Cleaning the screen

To clean the screen, use anti-static products.

Precautions governing optical connections

- The normal operating life of an optical connector is usually of the order of a few hundred manipulations. It is therefore advisable to manipulate the optical connections as rarely as possible.
- The instrument is designed to function correctly in a non - hostile environment, hence the cleanliness of the optical connectors as well as their delicate manipulation is paramount to the instrument's measurement abilities.
- The optical connector must therefore be clean and dust-free. If the optical connection is not being used, protect the connections of MTS^e using the covers provided.

As an example, the use of connectors that have not been cleaned will represent an error of the order of 10% for all measurements. This error is added to other errors present, for example the quality of the fiber (circularity and concentricity), the means of alignment (axis alignment, distance between fiber faces, quality of fiber face) and propagation modes.

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Cleaning the optical cable connector

Note If your module has an universal connector, unscrew its adaptor to access the ferule.

- Use a non degradable type of paper, such as Joseph paper, soaked in ethanol.
- Pay particular attention to the polished face of the fiber, rubbing it in a perpendicular motion to the fiber.

Cleaning the optical inputs or outputs of the MTS^e

- Squirt a highly flammable solvent (such as ethanol or «Trijelt») into the connector.
- Blow out the connector using a clean dry air supply from an aerosol can fitted with an extension.

Battery replacement

The MTS^e lithium battery found on the microprocessor board ensures that date, hour and certain information are not lost when the instrument is powered down.

Checking the battery

If there is doubt as to whether the battery is to be changed or not, switch off the instrument. On switching the instrument on again, check whether the date is still correct. If the date has been lost, the battery needs replacing.

Contact your nearest Wavetek Customer Service Centre.

This battery has a lifetime of more than five years.

Battery replacement should not be carried out by the user:
this may be dangerous to the microprocessor board
(certain components may be damaged or destroyed)
and requires special tools

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Chapter

Technical specifications 11

This chapter gives the specifications of:

- ❏ the MTS 5100^{e} and MTS 5200^{e} mainframes
- ❏ the OTDR modules
- ❏ the OTS modules
- ❏ the available options and accessories.

Mainframe specifications

Display

Screen:

- 8" Black & White or color passive (option 5000/PAS) or 8.4" TFT color (option 5000/COL)
- High resolution display
- Vertical scale display resolution of 0.001 dB
- Horizontal scale display resolution of 0.01 m (0,4 inch)
- Screen saver

Adjustment

- Contrast (Black & White or color passive screen)
- Backlight intensity

Storage

Medium

- RAM: 3Mb
- Optional 1 Gb Hard disk
- Optional 3.5 inch MS DOS compatible HD floppy disk drive

Storage capacity

- 400 OTDR traces typical in internal memory
- 250 OTDR traces typical on HD floppy disk
- Bellcore GR196 or TD 3000 Laser Precision (write only) compatible format for OTDR modules; Wavetek format for OTDR and OTS modules.

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Input/Output

- RS232C
- Ethernet (option)
- Centronics
- IEEE-488 GPIB (option), for MTS 5200^e only.

Internal printer (optional for MTS 5200^e only)

- Reference 5200/PR
- High quality (graphical) thermic printer
- 832 dots / line
- paper width: 112 mm.

Power supply

Batteries

- Up to 2 Nickel Metal Hydrid batteries
- Battery autonomy at 25° C (for 1 battery):
  - up to 8 hours of standard use, with normal backlight, according to Bellcore / Telecordia GR-196-CORE standard.
  - up to 3 hours with permanent acquisition, with normal backlight
  - up to 2.5 hours with permanent acquisition, with high backlight

AC/DC Adapter / Charger

	MTS 5100^e	MTS 5200^e
Reference	5003AC/DC adapter / charger	5007AC/DC adapter / charger
Input	100-250 V 50-60 Hz 1.6 A	85-264 V 47-400 Hz 1.3 A
Output	12 V DC 4.2 A	12 V DC 55 Watt max.
Compliant	CE	CE

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Dimensions

Base unit	MTS 5100^e	MTS 5200^e
Height	90 mm	130 mm
Width	235 mm	235 mm
Depth	300 mm	300 mm
Weight	3.5 kg including 1 module & 1 battery	5.5 kg including internal printer, 2 modules & 1 battery

Dimensions of the external keyboard (optional): 280 x 130 x 25 mm (11 x 5.1 x 1 inch).

Environmental conditions

Vibration

The MTS^e is able to withstand the following vibration tests:

- Complete test consists of 6 cycles for each of the 3 axes x, y, z.
- One cycle sweeps from 5 Hz to 200 Hz and back down to 5 Hz with a sweep duration of one minute per octave.
- 3 mm amplitude displacement test for the range of 5 Hz to 9 Hz.
- 1G acceleration test for the range of 10 Hz to 200 Hz.

Temperature range

- Operating on mains, options not included: -20° C to + 50° C (- 4°C to + 122°F)
- Operating, specifications guaranteed, all options included: 0° C to +40° C (+ 32°F to + 104°F)
- Storage: -20° C up to + 60° C (- 4°F up to + 140°F)

Humidity

- 95% without condensing

EMI/ESD

- CE compliant

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OTDR Measurement characteristics

Distance measurement

- dual cursors
- distance displayed with respect to the calibration of the fiber's group index
- group index adjustable from 1.30000 to 1.70000 in 0.00001 step
- display resolution: 1 cm (0.39 inch) max
- cursor resolution: 1cm (0.39 inch) max
- sampling spacing: from 4 cm (1.57 inch), with up to 128 000 acquisition data points
- accuracy: ±1 m ± 10^{-5}x distance ± sampling resolution (excluding group index uncertainties)

Attenuation measurement

- dual cursors
- display resolution: 0.001 dB
- cursor resolution: 0.01 dB
- accuracy: ± 0.05 dB / dB ± 0.05 dB

Reflectance measurement

- display resolution: 0.01 dB
- accuracy: ± 4 dB

Automatic measurement

- Automatic measurement of all signal characteristics. Slope measurement by linear regression or 2 points measurements.
- Thresholds for fault display:

  0 to 5.99 dB in 0.01 dB steps for event threshold

  -11 to -99 dB in 1 dB steps for reflectance

  0 to 1.99 dB/km in 0.001 dB/km steps for slope
- Display of fiber segment slope and attenuation
- Display of position and loss
- Display of reflectance
- Display of ORL

Manual measurement

- measurement of slope between the cursors
- measurement of the loss between two fiber sections
- measurement of the reflectance of a reflective event
- measurement of the Optical Return Loss between the two cursors.
- measurement of a splice either by 2 point or 5 point method

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OTS measurement characteristics

The OTS modules comprise: a Power meter, Light sources and combinations of Light source/Power meter.

Note Light source = Laser source or Led source

A complete range of optical connectors and adaptors is available.

Light source specifications

- Transmission of a dual wavelength signal on the same connector.
- Transmission of a signal indicating the wavelength transmitted.
- Modulation of the transmitted signal.
- Variable transmission power (for Laser source only)

Power meter specifications

- Choice of wavelength from 800 to 1650 nm in 1 nm increments.
- Automatic detection of the wavelength and the modulation.
- Selection of automatic or manual calibration.
- Manual or automatic storage and printing of the results.
- Audio alarm signal when the results is outside the chosen threshold.
- Reference level stored in memory.
- Automatic zero adjustment.
- Result display in dBm, dBr or W (mW, µW or nW).
- Alternating 1310/1550 nm (laser source) or 850/1300 nm (LED source) measurement option.
- Display of average result or real time result.

Modules, Options and Accessories

OTDR modules

Multimode OTDR modules

The specifications of the 5023 module are the specifications of the modules 5021 and 5022 according to the wavelength.

Wavelength	850 nm	1300 nm	850 & 1300 nm
Multimode Modules	5021MM	5022MM	5023MM
Module ML			5023ML

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Singlemode OTDR modules available

The specifications of the 5026 (SR, DR, HD, VHD) modules are the specifications of the modules 5024 and 5025 (SR, DR, HD, VHD) according to the wavelength. The specifications of the 5029 VHD module are the specifications of the 5025 and 5027 VHD according to the wavelength.

Wavelength (nm)	1310	1550	1310 & 1550	1625	1550 & 1625
Short Range	5024SR	5025SR	5026SR		
Medium Range High Resolution	5024DR	5025DR	5026DR		
High Dynamic Long Range	5024HD	5025HD	5026HD	5027HD *(RTU)*	
			5036 HD		
Very High Dynamic		5025VHD	5026VHD	5027VHD	5029VHD

OTDR module options

502X/VFL/FC	VFL option for OTDR module with FC connector
502X/VFL/ST	VFL option for OTDR module with ST connector

OTS modules available

Power meter: 50600 PM (800- 1650 nm)

Singlemode Laser source

Wavelength (nm)	1310	1550	1310&1550
Laser source	50540 LS	50550 LS	50560 LS
Laser source + Power meter	50640 LTS	50650 LTS	50660 LTS
Laser source + Power meter + Talkset	50641 LTS/TS	50651 LTS/TS	50661 LTS/TS

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LED source

Wavelength (nm)	850	1300	850&1300
LED source + power meter	50610 LTS	50620 LTS	50630 LTS
LED source + Power meter + Talkset	50611 LTS/TS	50621 LTS/TS	50631 LTS/TS

Chassis options [1]

5000/PAS	Color passive display
5000/COL	Color TFT display
5000/FD	Floppy disk unit
5000/HDisk	Hard disk
5000/Eth	Ethernet Interface. This option includes: - an adapter RS232/Ethernet - an Ethernet crossed cable for direct connection to the PC. - a software WS-FTP pro. - the init file for the software WS-FTP pro in a diskette.
5200/PR	Internal printer with (MTS 5200^e only)
5200/IEEE	IEEE interface (MTS 5200^e only)
5200/VGA	Computer display output (MTS 5200^e with color TFT display only)

Accessories supplied with the instrument

5000M02	User manual in English
5001	Rechargeable battery
	Mains lead and AC/DC adaptor:
5002/1	• for Europe
5002/2	• for United Kingdom
5002/3	• for USA

Other accessories (options)

5000/Keyb	External keyboard
	Additional AC adapter / Charger MTS 5100^e
5003/1	• for Europe

1. Must be ordered with the instrument

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5003/2	• for United Kingdom
5003/3	• for USA
5004	Soft carrying case for **MTS 5100^e**
5005	Hard transit case for **MTS 5100^e**
5006	Cigarette lighter Power Adapter
	Additional AC Adapter / Charger for MTS 5200^e
5007/1	• for Europe
5007/2	• for United Kingdom
5007/3	• for USA
5008	Batch of paper rolls for the MTS 5200^e internal printer

Application software

9551	WinTrace PC processing software
9552	WinWDM PC processing software
9558	WinCable software to generate measurement report under Windows™
5996/MTS	WS-FTP Pro software to backup the OTDR hard disk to a PC

Connectors supplied with the MTS^e

With OTDR singlemode modules and Light source

One connector is supplied per module: either an universal connector (UNI) with an adapter (FC, SC, etc.) or a fixed connector (FC, SC, etc.).

FC or Universal connector with adaptor
SC or Universal connector with adaptor
ST or Universal connector with adaptor
DIN or Universal connector with adaptor
E2000
EC
FC/APC or universal low reflectance connector with adaptor
SC/APC or universal low reflectance connector with adaptor
DIN/HRL or universal low reflectance connector with adaptor

With OTDR multimode modules

One connector is supplied per module: either an universal connector (UNI) with an adapter (FC, SC, etc.) or a fixed connector (FC, SC, etc.).

FC or Universal connector with adaptor
SC or Universal connector with adaptor
ST or Universal connector with adaptor

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DIN or Universal connector with adaptor

Power meter adapters supplied with the MTS[e]

for connector VFO: 506VFO
for connector FC/PC:506FC
for connector ST: 506ST
for connector DIN: 506DIN
for connector D4: 506D4
for connector PFO: 506PFO
for connector SC: 506SC

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Specifications of the OTDR modules

Wavelength and pulsewidth

Multimode Modules			
	5023MM		5023 ML
	5021MM	5022MM	
Wavelength[a]	850 ± 20 nm	1300 ± 20 nm	8500/1300 ± 20 nm
Dynamic range[b] with long pulse	20 dB	18 dB	16/14 dB
RMS[c]	25 dB	23 dB	18/16 dB
Pulsewidth	3 ns to 200 ns		3 ns to 200 ns
Dead zone[d] at 3 ns - Event dead zone - Attenuation dead zone	 1.5 m 5 m	 1.5 m 5 m	 2 m 10 m

a. laser at 25°C at 50ns

b. Specified values, at 25°C, corresponding to the one-way difference (in dB) between the extrapolated backscattering level at the start of the fiber and the level containing 98 % of noise data points, after 3 minutes averaging.

c. Typical value at 25°C corresponding to the one-way difference (in dB) between the extrapolated backscattering level, at the start of the fiber and the RMS noise level, after 3 minutes averaging.

d. Typical Values at 25°C :

- The event dead zone is measured at 1,5 dB down from the peak of an unsaturated reflective event.
- The attenuation dead zone is measured at ± 0.5 dB from the linear regression on a reflectance type FC/APC (-50 dB).

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Singlemode Modules						
Modules	**Short Range**	**High Resolution Medium range**	**High Dynamic Long range**		**Very High Dynamic Long range**	
	5024/25/26 SR	**5024/25/26 DR**	**5024/25/26 /36 HD**	**5027 / 36 HD**	**5024/25/26 VHD**	**5029 VHD**
Wavelength[a]	1310 / 1550 ± 20 nm	1310 / 1550 ± 20 nm	1310 / 1550 ± 20 nm	1625 ± 10 nm	1310 / 1550 ± 20 nm	1550/1625 ± 20 nm
Dynamic range[b] with long pulse	27,5 / 25 dB	31 / 29 dB	36,5 / 35 dB	35 dB		
RMS[c]	31 / 29 dB	35 / 33 dB	40 / 38 dB	39 dB	42 / 43 dB	43 / 41 dB
Distance range	260 km		380 km		380 km	
Pulsewidth	10 ns to 10 µs	5 ns to 10 µs	10 ns to 20 µs		10 ns to 20 µs	
Dead zone[d] - Event dead zone - Attenuation dead zone	(at 10 ns) 4 m 25 m	(at 5 ns) 1 m 15 m	(at 10 ns) 4 m 25 m		(at 10 ns) 8 m 30 m	

a. laser at 25°C at 10 µs

b. Specified values, at 25°C, corresponding to the one-way difference (in dB) between the extrapolated backscattering level at the start of the fiber and the level containing 98 % of noise data points, after 3 minutes averaging.

c. Typical value at 25°C corresponding to the one-way difference (in dB) between the extrapolated backscattering level, at the start of the fiber and the RMS noise level, after 3 minutes averaging.

d. Typical Values at 25°C :

- The event dead zone is measured at 1,5 dB down from the peak of an unsaturated reflective event.
- The attenuation dead zone is measured at ± 0.5 dB from the linear regression on a reflectance type FC/APC (-50 dB).

Laser

Laser classes applicable to the MTS[e] modules:

	Reference standard	
Modules	**EN 60825-1 :1994**	**FDA21CFR§1040.10**

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Multimode MM and ML - at 1300 nm - at 850 nm	 Class 1 Class 3A	 Class 1 Class 1
Singlemode SR, DR	Class 1	Class 1
Singlemode HD - at 1310 nm, 20 µs - at 1310 nm, other pulse widths - at 1550 nm	 Class 3A Class 1 Class 1	 Class 1 Class 1 Class 1
Singlemode VHD - at 1310 nm, 10 and 20 µs - at 1310 nm, other pulse widths - at 1550 and 1625 nm	 Class 3A Class 1 Class 1	 Class 1 Class 1 Class 1
VFL option	Class 2	Class 2

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Ranges

Ranges for MM and 5023ML modules

	3 ns	20 ns	50 ns	200 ns
500 m (1.6 kft)	x	x	x	
1 km (3.25 kft)	x	x	x	x
2 km (6.5 kft)	x	x	x	x
5 km (16 kft)	x	x	x	x
10 km (33 kft)	x	x	x	x
20 km (65 kft)	x	x	x	x
40 km (131 kft)		x	x	x
80 km (262 kft)				x

Ranges for SR modules

	10 ns	30 ns	100 ns	300 ns	1 µs	3 µs	10 µs
2 km (6.5 kft)	x	x	x				
5 km (16 kft)	x	x	x	x			
10 km (33 kft)	x	x	x	x	x		
20 km (65 kft)	x	x	x	x	x	x	
40 km (131kft)	x	x	x	x	x	x	x
80 km (459kft)			x	x	x	x	x
140 km (459 kft)				x	x	x	x
260 km (853 kft)							x

Ranges for DR modules

	5 ns	20 ns	100 ns	300 ns	1 µs	3 µs	10 µs
2 km (6.5 kft)	x	x	x				
5 km (16 kft)	x	x	x	x			
10 km (33 kft)	x	x	x	x	x		
20 km (65 kft)	x	x	x	x	x	x	
40 km (131 kft)		x	x	x	x	x	x
80 km (262 kft)			x	x	x	x	x
140 km (459 kft)				x	x	x	x
260 km (853 kft)					x	x	x

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Ranges for HD modules

	10 ns	30 ns	100 ns	300 ns	1 µs	3 µs	10 µs	20 µs
5 km (16 kft)	x	x	x	x				
10 km (33 kft)	x	x	x	x	x			
20 km (65 kft)	x	x	x	x	x	x		
40 km (131kft)	x	x	x	x	x	x	x	x
80 km (262kft)	x	x	x	x	x	x	x	x
140km (459kft)		x	x	x	x	x	x	x
260km (853kft)					x	x	x	x
380 km							x	x

Ranges for VHD modules

	10 ns	30 ns	100 ns	300 ns	1 µs	3 µs	10 µs	20 µs
5 km (16 kft)	x	x	x	x				
10 km (33 kft)	x	x	x	x	x			
20 km (65 kft)	x	x	x	x	x	x		
40 km (131kft)	x	x	x	x	x	x	x	x
80 km (262kft)	x	x	x	x	x	x	x	x
140km (459kft)		x	x	x	x	x	x	x
260km (853kft)				x	x	x	x	x
380 km						x	x	x

Ranges for 1625 nm 5027 modules (RTU)

	10 ns	30 ns	100 ns	300 ns	1 µs	3 µs	10 µs	20 µs
5 km (16 kft)	x	x	x	x				
10 km (33 kft)	x	x	x	x	x			
20 km (65 kft)	x	x	x	x	x	x		
40 km (131kft)	x	x	x	x	x	x	x	x
80 km (262kft)	x	x	x	x	x	x	x	x
140km (459kft)		x	x	x	x	x	x	x
260km (853kft)				x	x	x	x	x
380 km							x	x

Specifications of the VFL option (OTDR module)

- wavelength: 635 nm ± 15 nm at 25 °C
- fiber length: up to 5 km

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Specifications of the OTS modules at 25 °C

Light sources

	Laser sources	LED sources		
Wavelength (source at 25°C)	1310 & 1550 ± 30 nm	850 nm ± 30 nm	1300 nm ± 30 nm	850 & 1300 nm ± 30 nm
Spectral width	< 5 nm	50 nm	150 nm	50 / 150 nm
Stability in 1 hour Stability in 24 h.	± 0,05 dB ± 0,15 dB			
Calibrated output power	0 dBm	-17 dBm	-19 dBm	-18 / -20 dBm
Variable output power	0 to - 10 dBm			
Modulation of transmitted signal	270 Hz, 330 Hz, 1 kHz and 2 kHz			

Possibility of alternated transmission at 1310/1550 nm (Laser source) or 850/ 1300 nm (LED source), every 10 seconds approx.

Multiple Wavelength Power Meter

Calibrated wavelengths: 850 / 1310 / 1550 nm

Possible wavelengths: 800 to 1650 nm in 1 nm increments

Accuracy for calibrated wavelengths: ± 0,2 dB (at - 30 dBm, FC/PC)

Resolution: 0,01 dBm / 0,01 nW

Measurement range: + 5 to - 65 dBm (at 850 nm)
+ 5 to - 70 dBm (at 1310 and 1550 nm)

Possibility of alternated measurement at 1310 and 1550 nm.

Power Meter memory

- Capacity: 300 results
- Stored parameters for manual or automatic measurement:
  - Date / time
  - Wavelength
  - Measurement result (dBm)
  - Reference (dBm)
  - Received mode (CW, 270 Hz ... 2 kHz)

Specifications of the Talkset option (OTS module)

- Dynamic: 35 dB typical at 25°C

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Specifications WDM modules

Typical values measured at 25° C, unless otherwise stated.

	Module 5071- C band	Module 5073- C+L band
Wavelength		
Range	1525-1570 nm	1525-1610 nm
Sweep time (real time)	‹ 1 s	‹1,5 s
Accuracy [a]	± 10 pm	
Display Resolution	1 pm	
Min. spacing between channels	10 GHz (80 pm)	
Optical Bandwidth (FWHM)	35 pm	
Power levels		
Display range	- 90 dBm at + 30 dBm	
Display Resolution	0,01 dB	
Measurement range on a channel	- 70 dBm at + 10 dBm	
Max. admissible power: - total (before signal cut off) - for a channel	 + 20 dBm + 10 dBm	
Accuracy [b]	± 0,5 dB max	
Linearity [1]	±0,1 dB	
Flatness	± 0,2 dB[c]	± 0,2 dB[d]
Polarization dependence (PDL)	± 0,2 dB	
ORL (Optical Return Loss)	› 35 dB	
ORR (Optical Rejection Ratio)[e]-	40 dB at 0,8 nm from the carrier 34 dB at 0,4 nm from the carrier	

a. from -40 dBm to +5 dBm.
b. at -30 dBm and 1550 nm, excluding the uncertainty due to the input connector.
c. at -30 dBm and in the range 1530 nm - 1565 nm (reference : 1550 nm)
d. at -30 dBm and in the range 1530 nm - 1605 nm (reference : 1550 nm)
e. from the top of a carrier, in the range 1530 to 1605 nm and at 0 dBm

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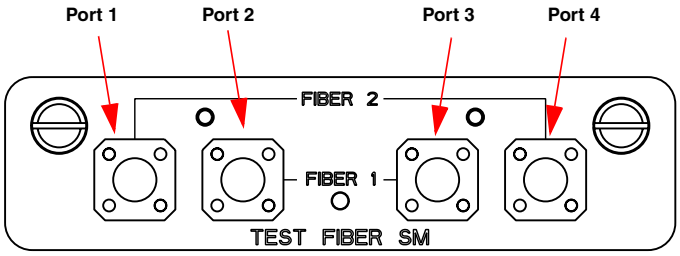
Information about the 5020TF fiber modules

The 5020 TF single-mode and multi-mode contains two reels of fiber to be used with the reflectometer. They are destined for training, demonstrations and can be used as a launch fiber.

Note

As these modules are not qualified as measurement devices, there is no need for calibration certificate.



Front panel of a module

	Module 5020TF/MM (Multi-mode)	Module 5020TF/SM (Single-mode)
Type of fiber used	Corning MM	Corning SMF 28
Recommended group index	1.50140 850nm ; 1.49660 @ 1310nm	1.46750 @ 1310nm ; 1.46810 @ 1550/1625nm
Length of fiber 1 Length of fiber 2	300 ± 30 m 300 ± 30 m	466 ± 23 m 1000 ± 50 m
Loss of the connectors	0.5 dB [a]	

a. Guaranteed to 1625 nm, except for the port 1 of fiber 2.

Advice on how to use the fiber 2 (long fiber)

Given that the loss per unit on fiber 2 may be higher near port 1:

- when measuring a dead zone, it is preferable to connect the reflectometer to the port 4.
- when measuring the insertion loss of a connector located after the launching cable, the reflectometer should be connected to port 1.

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